NUTRITION AND DIET THERAPY

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NUTRITION

and DIET THERAPY

A TEXTBOOK OF DIETETICS

FAIRFAX T. PROUDFIT, *Instructor in Nutrition and Diet Therapy, University of Tennessee College of Medicine; University of Tennessee School of Nursing; Director of Dietary Department, John Gaston Hospital, Memphis, Tennessee.*

CORINNE HOGDEN ROBINSON, *Lecturer in Nutrition and Dietetics, Temple University School of Medicine, Philadelphia. Formerly Instructor in Nutrition and Diet Therapy, Columbia University School of Nursing; Supervising Ward Dietitian at Presbyterian Hospital, New York City, 1941–1944.*

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Preface to the Ninth Edition

The experience of recent years has proven that food is truly a potent weapon of warfare; in the years to come it will be an even greater factor in the maintenance of peace and good will among nations. The happiness of a people depends on radiating health and vitality which are the essence of good nutrition. Never before in the history of the world has such great emphasis been placed on the role of nutrition in the welfare of mankind. Progress has been so rapid in the science of nutrition that it is necessary to undertake frequent revisions of textbooks dealing with those principles and practices concerned with feeding of the healthy and the sick. In the ninth edition of this textbook attention has been directed toward a simplification of subject matter without losing anything of value, and also to a complete modernization of material in accord with the newest findings of nutrition research. The authors here present a completely rewritten and streamlined version.

The first section dealing with normal nutrition has been rearranged from the previous edition in that proteins, carbohydrates, and fats are each discussed before energy metabolism. In our opinion this is a more logical development; it is like buying the combustion engine before being concerned about the fuel which the engine will burn! An important addition to the first section is the chapter on "Safeguarding the Food Supply" in which food poisoning, food preservation, and food legislation are discussed as related subjects.

Section II, "Normal Nutrition in Special Conditions," is organized as in the eighth edition, but a new chapter, "Feeding the Aged," has been included.

Perhaps the greatest simplification has been carried out in the section on Diet Therapy. The chapter headings of the previous edition have been retained but with some rearrangement of the order of presentation. The modern trend in diet therapy is towards fewer and fewer special diets since it is realized that the best dietary treatment for many conditions is a regular diet which may some-

times be modified but slightly. The principles of dietary modifications are illustrated by diets which are presented in a uniform pattern so that comparison of the various diets may be made quickly. The calculations of food values for these diets have been omitted since specific figures can be so misleading if the portions are not served exactly as indicated.

Projects have been added to the end of each chapter to aid the student in making practical application of the nutrition principles discussed. The brief bibliography and the review questions which are a new feature in this edition should be a guide in the study of any given subject.

Several additions to the appendix should enhance the usefulness of the book. The "Dietary Case Studies" are intended for use by the student nurse while she is getting her practical experience in diet therapy. The discussion on "Methods of Calculation of Food Values" is designed to aid the student in her determination of the contributions foods make to the diet. The table on physiological constants has been completely revised and elaborated. Some of the tables appearing in the text in earlier editions have been placed in the appendix for greater convenience. All of the tables have been brought up to date in accordance with the latest data on food values.

The textbook is well suited for use with the "Curriculum Guide of the National League of Nursing Education and the American Dietetic Association." An alternative outline of correlated courses in nutrition and cookery is presented in the appendix, and has proven to be very successful in the experience of many.

The authors are appreciative of the many suggestions and criticisms which have been helpful in the revision of this book, and are grateful to those who have given permission to quote from journals and books. They are especially grateful to Miss Nelda Ross, Director of the Nutrition Department of Presbyterian Hospital in New York City, for permission to use many of the diets from the *Manual of Diets* as illustrations of the principles discussed in the diet therapy section; and to Miss Wilma Baillie of the Macmillan Company for her conscientious assistance in the task of editing and proof reading.

THE AUTHORS

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SECTION I

Normal Nutrition

CHAPTER I

Food and Its Relation to the Body

Historical Sketch of the Science of Nutrition. Nutrition is a subject of ever increasing popularity to the layman and to the scientist. The earliest records of man have indicated a realization of the importance of food in health and disease, but the known principles of nutrition are mainly the result of modern research. The science of nutrition had its beginnings with the epoch-making discoveries of such men as Boyle, Black, Scheele, Priestley, Lavoisier, and others.

That animals are dependent upon the air they breathe for maintenance of life was demonstrated by Robert Boyle, an Englishman (1627-1691). One of his experiments to prove this consisted in placing a small animal such as a mouse in a vial and covering the open end with a membrane after which the air was gradually withdrawn from the bottle. The removal of the air resulted in restlessness on the part of the animal with unceasing attempts to escape from the jar.

Joseph Black, a Scotchman (1728-1799), in his thesis presented for the doctor's degree in 1754 described experiments on "fixed air," or carbon dioxide as we now know it. He also established the fact that animals expired fixed air and that they could not live in an atmosphere of it alone.

Oxygen was discovered simultaneously by Joseph Priestley, an Englishman (1733-1804), and K. W. Scheele, a Swedish apothecary (1742-1786). Priestley, a Unitarian clergyman and intimate friend of Benjamin Franklin, was able to spend most of his time in the laboratory through the benevolence of a friend. He found that a lighted candle kept in a closed jar would eventually be extinguished. Then he determined the effect of inserting a mint plant into the jar. At the end of ten days he found that the air had been restored and the candle would burn as brightly as before. He not

only established the necessity of oxygen for the burning candle but he determined its importance for animals.

Scheele performed experiments similar to Priestley's by placing two bees in a jar containing "fire air" (oxygen). The bees died after eight days because of replacement of the "fire air" with "fixed air." The relationship of these respiratory gases was thus clarified to a great extent.

Undoubtedly the greatest scientist of the eighteenth century was Antoine Laurent Lavoisier, a French nobleman (1743-1794), who repeated and confirmed the experiments on oxygen and carbon dioxide already performed by the various scientists of the day. Together with Laplace, another French worker, he constructed a chamber for the measurement of the amount of carbon dioxide given off by a guinea pig in ten hours. This was found to be equal to the burning of 3.33 grams of carbon in a closed vessel. He next determined the amount of ice which the guinea pig's body would melt in ten hours. The amount of heat necessary for melting the ice was found to be almost identical with that given off in burning 3.33 grams of carbon. It was then concluded that the carbon dioxide expired by the guinea pig came from burning the equivalent of 3.33 grams of carbon. Lavoisier is known as the father of the science of nutrition because he was the first to realize the relation of food to respiration.

Early in the nineteenth century Liebig, a professor of chemistry in Germany (1803-1873), found that the foods oxidized by the body were organic compounds containing carbon. He established the approximate amounts of oxygen necessary for the combustion of fat and starch. Voit and Pettenkofer in their laboratories in Munich constructed the first chambers for the measurement of carbon dioxide and oxygen exchange in respiration. One of their students, Rubner, ascertained the fuel value of proteins, fats, and carbohydrates.

Present Status of the Science of Nutrition. No branch of medicine offers a richer field of problems for research than does the science of nutrition. The present generation has witnessed such amazing discoveries as the synthesis of pure vitamins, a clarification of the role of proteins, essential fats, and minerals in body function, a better appreciation of the daily requirements of vitamins, addi-

tional data on food values, and a more satisfactory knowledge of methods for the detection of deficiency states. The contributions of the modern men of science are so many and so varied that even a sketch of them is beyond the scope of this book, but it is well to remind the reader to note the work of laboratories represented by such men as Lusk, Mendel, Rose, Sherman, Hopkins, Benedict, DuBois, McCollum, Osborne, Hart, and Steenbock to mention but a few.

The problems still to be solved in the field of nutrition are many and varied. Of immediate interest is the question of variations in food values with changing conditions of food gathering, storage, and processing. Methods for the determination of some of the food constituents need to be improved. The effect of the level of intake of one vitamin upon the requirement for another vitamin is still not entirely clear, nor do we know the full possibilities for prolonging the life span by the means of optimum diets. Then there are such practical problems as the distribution and pricing of food so that all peoples can have an adequate diet. The need for general education of the public in the importance of food and its relation to health is a pressing problem.

Objectives for the Student Nurse. The subject of nutrition is a basic course for the student nurse. A knowledge of the laws of nutrition is fundamental since the good health of the nurse, the patient, and the community may depend upon the practical applications of these principles. To that end it may be well to define some goals which the student should strive to attain in her study of normal nutrition, cookery, and diet therapy. The following objectives are suggested:

1. To acquire the proper attitude and convictions relative to the importance of nutrition in regulating the nurse's own health, that of the patient, and of the community.

2. To obtain an understanding of the fundamental principles governing the nutrition of normal individuals and the important part played by diet in the maintenance of the growth and health of those of all ages.

3. To obtain theoretical and practical knowledge of selection, purchase, care, preparation, and source of foods most commonly used and to apply this knowledge under varying circumstances.

4. To learn to appreciate the importance of color and attractiveness in food service and the value of good psychology in feeding patients.

5. To develop the ability to apply knowledge of normal nutrition to the principles of diet therapy in making the modifications in the diet to meet the existing pathological condition.

6. To learn to teach patients requiring special diets not only the importance of cooperation in carrying out the doctor's diet orders, but the most efficient way in which to do so. The attainment of this goal necessitates a recognition of the role which economic status and the social and religious customs of the patient may play. It presumes also a knowledge of the patient's medical history.

The Use of Food in the Body. Nutrition is the process necessary for the maintenance, growth, and renewal of all the body tissues. *Dietetics* is a study of food and its effect on the body in health and disease. *Food* may be defined as "any material which, when taken into the body will (a) yield energy, (b) build and renew tissue, or (c) regulate the body processes and internal conditions."[1] The composition of food, like the composition of the body, is complex. The twenty or more chemical elements of both occur as proteins, fats, carbohydrates, mineral salts, vitamins, and water. In foods these combinations are spoken of as nutrients, foodstuffs, or food constituents.

Classification of the Nutrients. The body is similar to an engine in that it needs building material, regulatory material, and fuel for its continued existence. The foodstuffs may then be classified according to the work they do in the body:

A. *Nutrients that build and renew the body tissues* (muscles, nerves, brains, bones, teeth, and blood)
   1. Proteins—essential for building of all tissues
   2. Mineral salts—chief constituents of bones and teeth, but also found in practically all cells of the body
   3. Water—constituent of all tissues

B. *Nutrients that regulate the body processes*
   1. Water
   2. Mineral salts
   3. Cellulose—a carbohydrate not available for fuel, but an excellent regulator of peristalsis (good elimination)

4. Vitamins
5. Proteins

C. *Nutrients that yield heat or energy*

1. Carbohydrates—represent the body's most economical source of energy
2. Fats—represent the most concentrated form of energy
3. Proteins—yield energy, but are considered of more importance as body-builders

Food Sources of the Nutrients. Even today, when publicity and propaganda have made the world diet-minded, the names protein, carbohydrates, fats, vitamins, and calories are more or less technical terms, carrying little, if any, definite meaning as far as the daily diet is concerned. The relationship must be explained and their meaning interpreted in terms of food materials. It is a waste of time to tell the average mother to give her child 50 or more grams of protein or 1800 to 2000 calories each day; but if she is told to give so much milk, meat, or eggs a day, or so much sugar, cereal, butter, vegetables, and fruits in each meal, she will understand and be able to follow directions with a greater degree of certainty and accuracy. The student nurse must learn to associate the nutrient with the most efficient food sources. The chart on page 8 shows graphically the relation of food to the body, and will give a general picture of the subject matter to be covered in the chapters which follow.

REVIEW QUESTIONS

1. Why is Lavoisier called the father of the science of nutrition?

2. Name a few discoveries which have been made in the science of nutrition during your lifetime.

3. What are some of the unsolved problems in the field of nutrition today?

4. Name six objectives which you as a nurse should keep before you in your study of nutrition.

5. Define: nutrition, dietetics, food, nutrient.

6. On what basis may the foodstuffs be classified? What nutrients comprise each class?

THE RELATION OF FOOD TO THE BODY

Form in Which the Nutrients Occur in the Body	Composition of the Body and of Food	Form in Which the Nutrients Occur in Foods
Carbohydrates. Chief source and most available form of energy; circulate in the blood as glucose; temporarily stored as glycogen; surplus stored as adipose tissue *Fats.* Used for the production of energy; deposited as neutral fat; an essential constituent of all body cells	Carbon Oxygen Hydrogen (Oxygen, Hydrogen: Water; Carbon, Oxygen, Hydrogen: Carbohydrates and Fats)	*Carbohydrates.* Starches, sugars, cellulose. Cereal grains and potatoes for starch; sugar cane, beet sugar, honey, syrups, sweet fruits, vegetables, and milk for sugars; fruits and vegetables for cellulose *Fats.* Butter, cream, fat meats, cheese, egg yolk, nuts, vegetable oils
Protein. Chief constituent of muscle tissue, brain and nerve tissue; essential constituent of red blood cells for building, maintenance, and growth; good but expensive source of energy	Nitrogen (Carbon, Oxygen, Hydrogen, Nitrogen: Proteins)	*Proteins.* Lean meat, eggs, milk are the complete proteins; nuts, cereal grains, legumes are partially complete proteins; gelatin is an incomplete protein
Sulphur. Essential for growth and development; acts as regulator	Sulphur	*Sulphur.* Furnished by protein-bearing foods
Iron. Essential to building of red cells (hemoglobin, the carrier of oxygen to tissues and carbon dioxide to lungs)	Iron	*Iron.* Liver, kidney, egg yolk, whole-grain cereals, dried beans, dried fruits, some green vegetables, molasses
Calcium and Phosphorus. Essential constituent of bones and teeth; necessary for growth; calcium necessary for the clotting of the blood	Calcium	*Calcium and Phosphorus.* Milk, cheese, whole grains, eggs, nuts, vegetables
Calcium, Phosphorus, Iron, Iodine, and other minerals act as body regulators, maintaining normal neutrality of the blood; essential for all cellular activity; act as food solvents; furnish acids or alkalies for the body secretions and excretions; essential for growth and development; as iodine, an essential part of thyroxin, the secretion of the thyroid gland	Phosphorus Potassium Magnesium Sodium Chlorine Iodine Copper Manganese Silicon, Zinc, Fluorine, Mercury, Aluminum, and other minerals. (Sulphur through other minerals: Mineral Salts)	*Potassium.* Meat, potatoes, and other vegetables *Sodium Chloride.* Milk, cheese, and most common foods *Iodine.* Sea foods, and plants grown in non-goiterous regions *Copper.* Associated with iron in meat (beef, liver), oysters, currants, mushrooms. The remaining minerals sufficient in foods already named
Hydrogen and oxygen as water essential constituent of all body cells; furnishes fluid medium for all body secretions and excretions		*Water.* In all beverages and in all foods not artificially dehydrated.
Vitamins. Essential for the functioning of all organs; essential for growth and development; necessary for health and well-being in all ages; essential for reproduction, lactation, and longevity	Vitamins A, B, C, D, G, and probably others	*Vitamins.* Butter, cream, cheese, eggs, milk, liver, green and yellow vegetables, tomatoes, fish oils, fresh fruits, canned fruits, commercially canned vegetables and fruits

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CHAPTER II

Proteins

It has been noted in Chapter I that food constituents may be classified according to their ability to build tissue, regulate body function, or supply energy. In 1838 a Dutch chemist, Mulder, described certain organic material which is "unquestionably the most important of all known substances in the organic kingdom. Without it no life appears possible on our planet. Through its means the chief phenomena of life are produced."[1] He called this complex nitrogen-bearing substance *protein* from the Greek verb meaning "to take the first place." The plural, proteins, is now retained as a group name to designate any of those substances which are of fundamental importance in tissue building and repair, and in the regulation of certain body functions.

Definition. Proteins are complex organic compounds composed of simpler substances called amino acids or building stones. They are essential to all animal and plant life.

Chemical Composition. All proteins contain the elements carbon, hydrogen, oxygen, nitrogen, and sulfur, nitrogen distinguishing this nutrient from carbohydrates and fats. Some proteins may also contain iron and phosphorus. These chemical elements are arranged in compounds known as amino acids, which in turn are linked together to form the larger protein molecule.

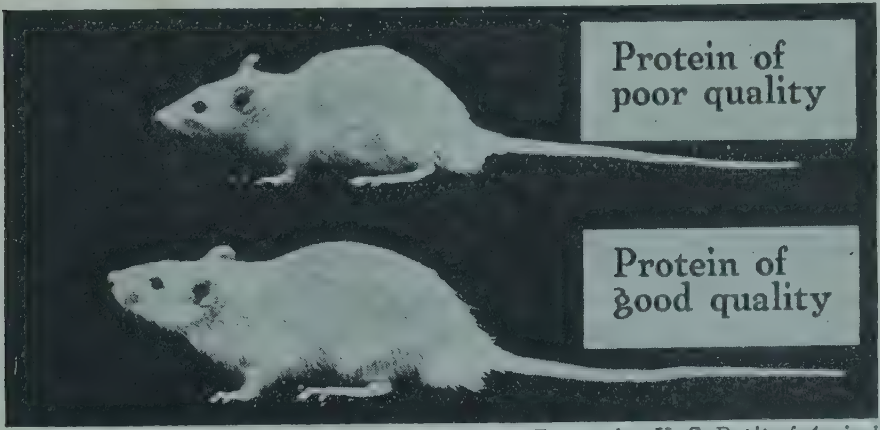
There are 22 different amino acids or building stones which may be combined in infinite ways to produce innumerable proteins found in the plant and animal world. Each species, plant or animal, combines the various amino acids in such a way that the resulting proteins are characteristic of that species alone. The composition of each type of tissue in the body is, moreover, varied and highly specific for its purpose. Proteins occur in all body tissues but muscle cells contain the highest percentage of this substance. They are also to be found in foods such as meat, milk, eggs, nuts, grains, and

legumes where again the protein will be distinct and specific for any given food.

Classification. Proteins may be classified according to their content of the amino acids which are essential for growth and for the maintenance and repair of tissues. Of the 22 known amino acids only 10 have been found to be indispensable; that is, these amino acids must be present in the foods we eat if tissue maintenance and a normal rate of growth is to occur. The essential or indispensable amino acids are:

Arginine	Methionine
Histidine	Phenylalanine
Isoleucine	Threonine
Leucine	Tryptophane
Lysine	Valine

Proteins are classified as complete, partially incomplete, or totally incomplete. The complete proteins contain the essential amino acids in sufficient quantities for maintenance and a normal rate of growth. For example, the proteins found in milk (casein and lactalbumin) and in eggs (ovovitellin and ovalbumin) are among the most efficient in tissue building and repair and hence are considered to be complete. Partially incomplete proteins will maintain life but they lack some of the amino acids necessary for growth. Gliadin which is found in wheat is a notable example of proteins of this class. Totally incomplete proteins are incapable of repairing or



Courtesy of Bureau of Home Economics, U. S. Dep't of Agriculture

Fig. 1. Effect of the Same Amount of Proteins of Different Qualities
Litter mates of the same sex, 12 weeks old. Weight of smaller, 117 grams; of larger, 198 grams.

building tissue and hence cannot support life, let alone promote growth. Zein, found in corn, and gelatin are classic examples of proteins which are incapable of even permitting life to continue.

Functions. It has been noted in Chapter I that proteins will supply in varying degree the three basic needs for food. Of primary importance is their use for the building of body cells, since in the human body all cells and all body fluids, except bile and urine, contain protein. Tissues undergo a constant daily wear and tear, and as an engine needs repair so the body requires a constant allowance of complete protein. Superimposed upon the daily wear and tear quota are additional requirements in special conditions. The growing child needs complete proteins in order that he may build new tissues. The pregnant woman not only must meet the requirements of maintenance for her own body but the additional demands by the developing fetus must be satisfied. The production of new protein in human milk entails a real demand for foods containing the ten essential amino acids. Under extraordinary circumstances an adult may build new tissues; for example, (1) following a long and debilitating illness, or (2) during the building of new tissues when a marked increase in activity entails the development of larger muscles.

Building of body cells is only one of the functions of proteins, however. Many proteins have highly specialized functions in regulation of body processes. Hemoglobin, an iron-bearing protein which is the chief constituent of the red blood cells, performs a highly important part in nourishing the body by carrying oxygen to the tissues. Serum proteins are of fundamental importance in the regulation of osmotic pressure. If there is a decrease in the serum proteins the water balance will be so disturbed that fluid will accumulate in the tissues. Proteins have the ability of behaving as acids or alkalies and are of great value in the regulation of acid-base balance. Many of the enzymes such as trypsin and pepsin are protein in nature. The construction of hormones such as insulin and thyroxin depends upon a supply of certain amino acids.

In the event that energy needs are not covered by carbohydrate and fat, proteins may also be used as a source of fuel, but they are less economical than the former. They not only occur in the more expensive food items, but their breakdown in the body entails more

work than is required for the breakdown of carbohydrates and fats.

Proteins are also important in their effect on body metabolism. The ingestion of all foods produces a stimulation of metabolism which in turn results in increased body heat or the feeling of warmth. This effect is known as the "specific dynamic action" of foods and is most pronounced following the eating of hearty protein meals. A diet high in protein will therefore be conducive to greater comfort in cold climates.

Digestion and Absorption. Protein in food cannot be used in its original form but must be changed to simpler substances. This is done by the process of digestion. There is no change in the mouth, the digestion of protein beginning in the stomach, first through contact with hydrochloric acid and then with the enzyme pepsin. The latter partially breaks down the protein to simpler substances, chiefly proteoses and peptones. The various products of protein digestion are split up further in the intestine by the action of trypsin, an enzyme present in the pancreatic juice. The final breakdown to amino acids is effected largely by erepsin, a powerful protein splitting enzyme in the intestinal juice. The amino acids then pass through the intestinal walls by way of the capillaries into the blood stream.

Metabolism. One of three fates awaits the amino acid circulating in the blood stream. Body tissues select those needed for building or repair and rearrange them to suit the purpose of the tissue in question. Secondly, the amino acids may be used in one of the many highly specialized body products such as hemoglobin, serum proteins, or enzymes. It is believed that this selection of amino acids and their manufacture into other products occurs in large part in the liver. The body does not store amino acids to any appreciable extent, although an individual apparently may have a fairly high reserve of protein which can be used in time of stress. Any amino acids which are left over after the above requirements have been met are therefore deaminized in the liver; that is, the amino group (NH_2) is broken off and eliminated by the kidney in the form of urea and a small amount of ammonia. The rest of the molecule containing carbon, hydrogen, and oxygen may be converted into carbohydrate or fat which can be used immediately for energy or stored for future energy needs. Approximately 58 per cent of the

protein eaten can be converted into glycogen (the form in which carbohydrate is stored in the body) and about 46 per cent may be changed to fatty acids.

Fuel Value. Every gram of protein burned in the body will yield 4 calories.

Standard Allowances for Protein. The amount of protein necessary to maintain life and support growth has been determined in a number of ways. The laboratory measures this by means of nitrogen balance studies. It is known that one gram of food nitrogen represents 6.25 Gm. of protein and that one gram of nitrogen in the urine is the result of the metabolism of 6.25 Gm. of protein in the body. Hence, if one subtracts the total output of nitrogen from the total intake an accurate estimate of protein or nitrogen balance can be obtained. Concisely, the method then consists in a quantitative analysis of the nitrogen content of food consumed and an equally careful determination of the amount of nitrogen excreted in the urine and feces. Whenever the intake and output are equal a state of *nitrogen equilibrium* exists. Such an equilibrium can be established in adult individuals at various levels of protein intake but when the intake is lowered markedly it will be found that more nitrogen is excreted than is being obtained in the food; this would indicate that the body is breaking down its own tissues in order to meet the daily demands. When this condition occurs a state of *negative nitrogen balance* exists. On the other hand a *positive balance* (intake of nitrogen is greater than the output) occurs whenever new tissue is being built as during childhood, in pregnancy, in lactation, and following a wasting disease. A state of nitrogen equilibrium is normal for the adult, and the lowest protein intake which would permit this would then be considered as the minimum daily need for protein. Several factors are apt to vary the requirement for protein such as (1) need for building material during childhood, in pregnancy, or in lactation, (2) composition of the diet with respect to carbohydrate and fat, (3) state of nutrition of the individual, and (4) quality or biological value of the protein consumed.

Much has been written about the advantages of high and low protein diets, but at the present time it is not possible to draw absolute conclusions as to the relative merits of the low protein diet as

compared with the high protein diet. There are, however, definite dangers in consuming a diet which is inadequate in either the quality or the quantity of proteins. A diet which is deficient in protein for a prolonged period of time will result in stunted growth, loss of weight because of the use of tissue protein for the daily metabolic requirements, secondary anemia, and a fall in the blood serum proteins with a resultant nutritional edema. Excessive protein, on the other hand, has not been conclusively proven to be harmful to the kidneys. The effect in stimulating body metabolism may make a very high protein intake undesirable in warm climates.

Because all foods do not contain proteins of equally good quality, and because individuals may vary somewhat from one another in their needs it is wise to allow a margin of safety in the diet. Sherman[2] has proposed that the adult should receive daily 1 Gm. of protein per kilogram of ideal body weight, this giving a factor of safety of about 50 per cent in most individuals. Calculated on the basis of weight in pounds this is equal to about 0.5 Gm. of protein per pound of body weight. The greatest amount of protein per unit of body weight is needed during childhood. Approximately one third of the protein required during infancy is stored by the body for building purposes (growth and development). As the child grows older, the protein stored for growth decreases until adult age is reached. A child under five years of age needs 3 to 4 Gm. of protein per kilogram of ideal body weight, whereas the older child needs 1½ to 2 Gm. per kilogram. The Committee on Food and Nutrition of the National Research Council[3] proposed the standards listed on page 16.

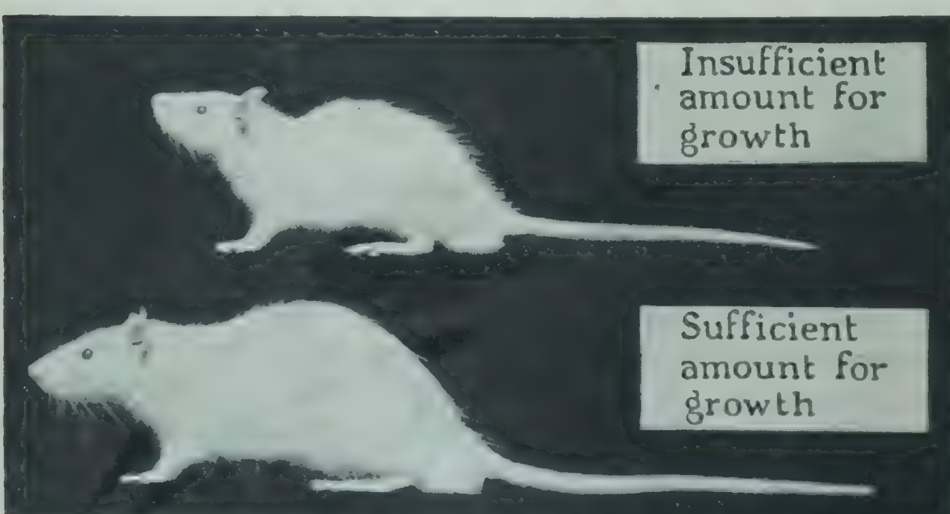
Protein allowances are sometimes stated as a percentage of the total caloric intake for the day. On this basis approximately 10–15 per cent of the total calories should be derived from protein. If a man weighing 70 kilograms (154 pounds) requires 2,800 calories per day, from 280 to 420 calories should be furnished by protein. In terms of grams this would be 280 ÷ 4 (fuel factor of protein), or 70 Gm. of protein per day; or 420 ÷ 4, or 105 Gm. of protein per day. An allowance for children of 15 per cent of the total calories per day to be derived from protein is believed to be the most satisfactory.

Protein allowances depend not only upon the quantity fed but

DAILY ALLOWANCES FOR PROTEIN[3]

	Protein Gm.
Man (70 kg.)	70
Woman (56 kg.)	60
Pregnancy (latter half)	85
Lactation	100
Children	
Under 1 year	3.5 per kg.
1–3 years	40
4–6 years	50
7–9 years	60
10–12 years	70
Children over 12 years	
Girls, 13–15 years	80
16–20 years	75
Boys, 13–15 years	85
16–20 years	100

also upon the quality. There is never a time when the body does not need complete protein. The optimal mixture of amino acids for human nutrition is not known but experience has shown that better nutrition is maintained if one half to two thirds of the total protein intake for children comes from the foods containing complete protein, whereas at least one third of the adult daily protein intake should come from these superior protein foods.



Courtesy of Bureau of Home Economics, U. S. Dep't of Agriculture

FIG. 2. EFFECT OF DIFFERENT AMOUNTS OF AN EFFICIENT PROTEIN
Litter mates of the same sex, 18 weeks old. Weight of smaller, 135 grams; of larger, 283 grams.

Food Sources. Foods are selected for protein (1) by the quality of protein they contain and (2) by the richness of amount of protein they contain, or both.

Protein of best quality*	Rich in amount	Lean meat, poultry, fish, shell-fish, kidney, liver, heart, sweetbreads, eggs, cheese
	Fair in amount	Milk—whole, skimmed, evaporated, dried, buttermilk, Bulgarian, acidophilus and other fermented milks; some nuts
	Low in amount	Cream
Protein of fair quality	Rich in amount	Soy beans; most nuts
	Fair in amount	Wholewheat products
	Low in amount	Green leafy vegetables
Protein of poor quality	Rich in amount	Legumes—dried peas and beans
	Fair in amount	Other cereal grains, as corn, oats, rice, potatoes, bread
	Low in amount	Most fruits and vegetables—raw, cooked, canned, or dried

*Foods in this group belong to the complete type of protein. Foods in the other groups are incomplete or partially incomplete.

Experience has proved that proteins from animal sources furnish better building materials than do the proteins from plants. However, it is possible to use some of the foods belonging to the incomplete group in combination with foods of the complete group. Cereals, for example, are made to fill the protein need completely by adding milk to them.

Gelatin, composed entirely of protein, lacks several of the essential amino acids and cannot be used alone to supply either the growth or maintenance needs of the body. It is not without its uses in nutrition, however, for this form of protein may be used to fill part of the protein quota if supplemented with other proteins.

Selecting the Day's Protein Food for Health. Growing children need the larger part (two thirds) of their protein intake from the best quality protein, while adults should take at least one third from the complete group. The following foods included in the daily diet will meet the complete protein allowance for a growing child and for an adult:

	Child		Adult	
	Amount	Protein Gm.	Amount	Protein Gm.
Milk	3 to 4 cups	24–32	2 cups	16
Egg	1	7	1	7
Meat	1 ounce	5–8	2 ounces	10–16
		36–47		33–39

SUMMARY

Proteins are complex substances made up of simpler compounds known as amino acids. These amino acids, in turn, contain the elements carbon, hydrogen, oxygen, and nitrogen, the last named distinguishing proteins from other nutrients.

Proteins are essential for building and repair of body tissue in general, and for regulation of many body functions. The maintenance of normal osmotic pressure, regulation of acid-base balance, transport of oxygen and carbon dioxide, and construction of hormones, enzymes, and immune bodies are but a few of the regulatory functions. Excess protein from the diet may be used for energy, although proteins are a wasteful source of fuel. In time of stress the body tissues themselves may be broken down for use as energy.

Food proteins are classified as complete or incomplete depending upon their ability or inability to maintain life and promote growth. Milk, cheese, eggs, and meat are the best sources of complete food proteins; soy beans are rich in protein of good quality; while legumes and cereals are fairly rich in protein of inferior quality.

Amino acids are the end products of protein digestion. They are absorbed by the blood stream to be carried to the tissues for immediate use in building or repair, or to the liver for construction of

highly specialized proteins, or for deaminization and subsequent use as energy.

The daily requirement for protein is that amount needed to maintain nitrogen equilibrium in a normal adult, or positive nitrogen balance in a growing child, pregnant or lactating woman, or where tissues are being replaced. This daily need of protein is thus dependent on (1) the quality of protein ingested, (2) the needs for growth, (3) the need for replacement of wasted tissue, and (4) the amount of carbohydrate in the diet, abundant carbohydrate being sparing on the amount of protein used for energy.

The daily allowance of protein for an adult is 1 Gm. per kilogram of body weight, while that for a child is 2 to 3 Gm. per kilogram of ideal body weight.

PROJECT

Prepare an outline or diagram which shows the digestion and all possible uses of the proteins contained in milk.

REVIEW QUESTIONS

1. What is an amino acid?
2. What is a protein? What chemical elements are always present in proteins?
3. What three classes of functions do proteins perform in the body? Discuss each class in detail.
4. Why is protein a poor source of energy?
5. Name the enzymes which participate in protein digestion. Where is each found?
6. Describe the stages of protein digestion.
7. What three fates await the amino acids after they are absorbed from the blood stream?
8. What is meant by positive nitrogen balance? negative nitrogen balance? nitrogen equilibrium? When does each condition occur?
9. What factors affect protein requirement?
10. Define complete, partially incomplete, and totally incomplete proteins. Give an example of each.
11. What foods are good sources of complete proteins?
12. What foods are valuable for supplementary purposes?

13. What foods should be included in the daily diet to insure adequate protein intake for the adult? for the child?

14. What is meant by each of the following:
    a. Deamination
    b. Specific dynamic action
    c. Essential amino acid
    d. Protein-sparing action of carbohydrate

15. What are the effects of insufficient protein in the diet?

16. What is the normal value for total serum protein? albumin? globulin? (See Table IX in the Appendix.)

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CHAPTER III

Carbohydrates

Carbohydrates represent the body's most available as well as most economical source of energy, not only on account of their wide distribution in nature but likewise because the normal body uses carbohydrates more completely and more readily than it does either of the other organic nutrients.

Definition. Carbohydrates are defined as "simple sugars or substances which can be reduced to simple sugars by hydrolysis."*

Classification. The carbohydrates may be classed in three groups:

I. *Monosaccharides or Simple Sugars*

A. *Glucose,* sometimes called "dextrose" or "grape sugar", is found in sweet fruits as grapes, sweet corn, certain roots, and is the form of carbohydrate circulating in the blood.

B. *Fructose,* also known as "levulose", is closely associated with glucose; honey is its richest food source.

C. *Galactose* results from the hydrolysis of lactose or milk sugar. It does not occur freely in nature.

II. *Disaccharides or Double Sugars*

A. *Sucrose,* the table sugar with which we are familiar, is found in sugar cane, sorghum cane, sugar beets, in the sap of sugar maples and in many fruits and vegetables.

B. *Maltose,* or malt sugar, is the result of the action of a starch-splitting enzyme, amylase. It is the form of sugar found in sprouting grains and is also an intermediate product in the digestion of starch to glucose.

*Hydrolvsis means a chemical decomposition involving addition of the elements of water.

C. *Lactose,* or milk sugar, is the form of carbohydrate present in the milk of mammals. It, with glycogen, represents the only animal source of carbohydrates.

III. *Polysaccharides or Complex Sugars*

A. *Starch* is the form in which plants store carbohydrates. Cereal grains, seeds, roots, potatoes, green bananas, and other plants contain considerable starch.

B. *Dextrins* are products formed in the partial breakdown of starches by the action of heat or of enzymes.

C. *Glycogen,* the so-called animal starch, is the form in which the animal body stores carbohydrates for temporary use. As much as 200 to 300 grams may be stored in the liver; smaller concentrations are also found in the tissues and skin. Oysters and shell fish also contain glycogen.

D. *Cellulose* is the woody fiber of plants, which gives them their shape and form. It is to the plant what the bones are to the body.

Function. The chief function of this nutrient is to furnish the energy necessary to carry on the work of the body. Glucose is brought by the blood stream to the tissues for immediate use or to the liver where it is stored as glycogen for later use in supplying energy. Science has proved that a liver well stocked with glycogen functions much more efficiently than one in which the glycogen stores are poor (see high-carbohydrate diet in liver disturbances, Chapter XXVII). Carbohydrates taken in excess of the body's needs will be manufactured into fatty tissue and serve as a source of future fuel when needed. Glucose is recognized as the body's most useful emergency fuel and is the food most frequently introduced into the veins when other avenues for feeding the individual are closed. Carbohydrates are of value in the sparing of protein. In periods of lowered protein intake it is much easier to maintain nitrogen equilibrium if the diet contains an abundance of carbohydrates.

Digestion and Absorption. The cooking of foods containing starches is a valuable aid to the digestive process for the walls of the

starch cell are thereby ruptured and the material can be more quickly acted upon by the enzymes.

Simple sugars, the chief of which is glucose, require no preparation in digestion. They are ready to pass through the absorbing walls of the digestive tract as soon as they reach the small intestine. The double sugars are carried through one step in digestion to become simple sugars; and the complex sugars, the chief of which is starch, require two steps in digestion before they can be absorbed. Cellulose is not affected by the digestive juices but lends the bulk necessary to promote normal peristalsis. The following table gives a brief outline of the digestive processes which prepare all carbohydrates for their work in the body.

DIGESTION OF CARBOHYDRATES TO SIMPLE SUGARS

ACTION OF ENZYMES

Enzyme	Where Found	Digestive Changes
Starch-splitting		
Ptyalin	In saliva—a secretion of salivary glands in the mouth	Starch split to dextrins and maltose
Amylopsin	In pancreatic juice—a secretion of the pancreas poured into the small intestine	Starch split to dextrins and maltose
Sugar-splitting		
Sucrase	In pancreatic juice—a secretion of cells lining upper part of the intestine	Sucrose split to glucose and fructose
Maltase	In intestinal juice	Maltose split to two molecules of glucose
Lactase	In intestinal juice	Lactose split to glucose and galactose

It is seen that the greater part of the carbohydrates in food is broken down to glucose in the process of digestion. The simple sugars are absorbed by the capillaries in the walls of the intestines and are then poured into the blood stream, which carries them to the tissues and the liver.

Metabolism. Simple sugars through the action of insulin (the substance secreted by certain cells in the pancreas) are changed into glycogen and in that form are stored chiefly in the liver. Other enzymes convert glycogen to glucose when the latter is released by the liver to maintain a blood glucose level of approximately 1/10

of 1 per cent. This level is fairly constant in normal blood. If for any reason there is insufficient insulin secreted by the body to take care of the incoming carbohydrate, the blood sugar will rise and glucose may appear in the urine (Diabetes Mellitus, Chapter XXVIII).

Glucose furnishes most of the energy to carry on the work of the tissues (muscles and secretory glands). In muscle tissue the glucose is oxidized; that is, it combines with oxygen to release energy. The carbon in the glucose unites with oxygen to form carbon dioxide and the hydrogen combines with oxygen to form water. These end products, carbon dioxide and water, are excreted by the lungs and by the kidney. The heat that is present as a result of oxidation processes is used by the body for the maintenance of the normal body temperature.

Factors Affecting Use of Various Sugars. The various sugars show different characteristics, which must be considered especially in their use in infant feeding and in diet therapy. The first outstanding difference is in their intenseness in sweetening power, another is in their solubility in cold and hot water, and still another is in their sensitiveness to the action of bacteria, so that some of them ferment more readily than others.

With regard to the intensity of their sweetening power let us take sucrose as a basis for our estimation since this sugar represents by far the most widely used of the sugars.[1]

Sucrose	1	Glucose	$\frac{3}{4}$
Fructose	$1\frac{3}{4}$	Lactose	$\frac{1}{6}$
Maltose and galactose	$\frac{1}{3}$		

Gram for gram each of these sugars has the same caloric value. It is possible to use larger amounts of the less sweet sugars and thus increase the caloric value of the food without producing nausea which often results from oversweetened foods.

The difference in solubility in hot or cold water is likewise an important factor to be considered. The figures on page 25, given in the *Handbook of Chemistry and Physics*, will make more understandable the physician's orders for their use.[2]

Not all of the carbohydrate in every food is available as energy to the body. Most food tables list "total carbohydrate" which

TYPE	SOLUBILITY IN GRAMS PER 100 cc. OF WATER
Dextrose	83
Lactose	17 (in cold water)
	40 (in hot water)
Maltose	Very soluble
Sucrose	200 (in cold water)
Fructose	Very soluble
Starch	Insoluble
Glycogen	Very soluble
Dextrin	Very soluble in hot water

includes fiber and other non-utilizable carbohydrate. However, in the diversified diet, the proportion of unavailable carbohydrate is small, and for all practical purposes the total carbohydrate figures are sufficiently reliable.

Allowances in the Diet. From 50 to 60 per cent of the calories of the average diet are obtained from carbohydrate. Such a liberal use of this class of foods is advantageous because (1) they are easily digested and almost completely absorbed for efficient use in producing energy; (2) they can be stored as glycogen, a liberal supply of which exerts a beneficial effect on the function of the liver; (3) they are protein sparing in action; (4) they are widely distributed and economical; and (5) they enhance the palatability of the diet.

From the standpoint of normal nutrition an excessive amount over and above the average normal standards of any of the nutrients is inadvisable. Excess intake of carbohydrates in the form of concentrated sweets may lead to irritation of the mucosa of the gastrointestinal tract as well as fermentation and gas formation in certain abnormal gastric conditions. When the intake of energy from carbohydrates and fats exceeds the output of energy, the excess will be stored as adipose tissue. Excessive gains in weight are predisposing factors in the development of diabetes mellitus, cardiac conditions, and kidney disturbances.

Concentrated sweets likewise impair the appetites for other necessary foods. This is especially true for children. The increased use of sugar by the present generation has led to a displacement of some of the vitamin and mineral-rich foods in the dietary. In the selection of carbohydrate foods one should be concerned with the contributions which the food in question can make to the vitamin and

mineral requirements as well; this implies the liberal use of natural rather than refined foods.

Fuel Value. Every gram of carbohydrate burned in the body will yield four calories.

Sources of Starches and Sugars. Many carbohydrate foods contain both starches and sugars of varying complexity.

Sugars. Refined sugars — table, granulated, lump, pulverized, and confectioners; concentrated sweets — honey, molasses, corn and maple syrup, jellies, jam, preserves, marmalade, candies, sweet chocolate, cocoa; fruits — dried fruits, stewed fruits with added sugar, some fresh fruits such as grapes and bananas.

Starchy Foods. Cooked cereals, such as rolled oats, oatmeal, wheat cereals, rice, green corn; ready-to-serve cereals, such as corn flakes, wheat flakes, puffed grain, etc.; flours — wheat, rye, rice, barley, cornstarch, arrowroot, corn meal, tapioca, sago; foods made from flours — macaroni, spaghetti, noodles, breads, pastry, puddings, cakes; legumes — dried peas and beans; potatoes and other tubers; root vegetables.

PROJECTS

1. Calculate the carbohydrate content of:

   a. 60 Gm. of bread
   b. 120 Gm. of potato
   c. 150 Gm. of orange

2. Tabulate the carbohydrate and water content of 100 Gm. of each of the following: dry oatmeal, dry farina, puffed wheat, white flour, wholewheat bread, oranges, carrots, onions, strawberries, grapefruit, bananas, and potatoes. What observations are you able to make from this table?

REVIEW QUESTIONS

1. What is a carbohydrate? Of what elements is it composed?

2. How are carbohydrates classified? Name those found in each class and tell where they may be found.

3. Why are carbohydrates important in the diet? Why is their liberal use an advantage?

4. What harm may result from an excessive consumption of concentrated sweets?

5. Name the enzymes which participate in the digestion of carbohydrate. Where is each found? To what stage does it digest the carbohydrate?

6. What is the form of carbohydrate circulating in the blood? What is its normal concentration?

7. What is the role of insulin in carbohydrate metabolism?

8. What are the results of oxidation of carbohydrate in the body?

9. Name several good sources of sugars. Of starches.

10. What is the normal allowance for carbohydrate in the diet?

11. How many calories will 90 grams of carbohydrate yield?

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CHAPTER IV

Fats or Lipides

Fats, the second member of the energy-producing group, are almost as widely distributed in nature as are the carbohydrates, but they are not so readily or so liberally used for carrying on the work of the body. They may be defined as combinations of fatty acids and glycerol which are used by the animal body. They are further characterized by their insolubility in water although they dissolve readily in ether or chloroform.

Composition. Fats, like carbohydrates, are composed of carbon, oxygen, and hydrogen; however they differ from carbohydrates in that they contain much less oxygen and much greater proportions of carbon and hydrogen. They consist of about 76 per cent carbon, 12 per cent hydrogen, and 12 per cent oxygen. One molecule of glycerol $C_3H_5(OH)_3$, is combined with three molecules of fatty acids to build the common fat molecule.

Characteristics. The form, flavor, and melting point of a fat depends upon the kinds of fatty acids which are present in the molecule. There are a large number of fatty acids, some containing only 2 carbon atoms and some as many as 24 carbon atoms all hooked to each other in a chainlike fashion. Some of them are "unsaturated," that is, they do not contain enough hydrogen to combine with all the free carbon bonds. The commonest fatty acids found in foods are stearic ($C_{18}H_{36}O_2$), palmitic ($C_{16}H_{32}O_2$), and oleic ($C_{18}H_{34}O_2$) acids, the last named being unsaturated.

A long chain of carbon atoms will produce a harder fat than a short chain. Tallow and suet which are made up largely of the long-chained stearic acid are hard fats. Butter, which is composed of various fatty acids having fewer carbon atoms, is a soft fat. Butyric acid, $C_4H_8O_2$, is the one from which butter takes its name although it constitutes only about 5 per cent of the fatty acids found in this food. Unsaturated fatty acids will produce softer fats

than those which are saturated. As a matter of fact plant oils such as olive oil, cottonseed oil, and peanut oil are composed largely of the unsaturated oleic acid. On the basis of consistency fats may then be grouped as hard, soft, and oily.

Classification. Three types of fats or lipides are of importance in nutrition. They are:

1. *Neutral fats* which are merely combinations of fatty acids and glycerol. The food fats belong largely to this group. Most of the adipose tissue in the body is in this form.

2. *Phospholipides* which contain phosphoric acid and nitrogen in addition to the fatty acid and glycerol molecules. The phospholipides such as lecithin and cephalin are found prominently in the active body tissues such as brain, nerve, and muscle.

3. *Sterols* which are combinations of fatty acids and alcohols of high molecular weight. Cholesterol and ergosterol are the most important members of this group. They are precursors of vitamin D. Cholesterol is the only sterol occurring as such in the animal body. Appreciable amounts of it are normally found in the blood plasma and in the adrenal cortex. Abnormally it is present in high concentrations in walls of diseased blood vessels, in gallstones, and in the liver.

Functions. As energy-producing materials, fats furnish two and a quarter times as much energy as carbohydrates and are therefore known as the body's most concentrated source of energy. They supply this great amount of energy because a large quantity of oxygen is necessary for complete oxidation of the molecule. Deposits of fat in the body insure a reserve supply of fuel in times of stress. Certain fats as the phospholipides are of fundamental importance in the structure and functions of active body tissues, especially brain and nervous tissue. They also facilitate the passage of fats in and out of such cells as the epithelium of the intestines.

Aside from their importance in producing energy and in the active functioning of tissues, fats are valuable in the diet since they serve as (1) padding around the vital organs, holding them in place and absorbing the shocks to which they might otherwise be subjected, (2) subcutaneous fat to conserve the body heat by preventing its loss from the surface area, (3) sparers of body protein since as long as there is a sufficient amount of fats and carbohydrates

provided in the diet to furnish the energy needed to carry on the work of the body, body protein will not be used, (4) carriers of vitamins A, D, and E, (5) lubricants to promote good elimination of waste material from the gastro-intestinal tract, (6) depressors of the secretion of hydrochloric acid in the stomach thus delaying the emptying time and retarding the appearance of hunger, and (7) agents to enhance the palatability of the diet.

Digestion and Absorption. There is no digestion of fat in the mouth and very little in the stomach. Finely divided fats such as cream and egg yolk may be broken up by a gastric lipase in the stomach but the action is not important. Fats pass out of the stomach more slowly than the other nutrients. This is believed to be because of the depressing effect fat exerts upon the flow of gastric juice. Thus fried food may leave the stomach more slowly than foods prepared in other ways. A very slow passage of food may permit a certain amount of decomposition to take place, and decomposition products are highly irritating to the tender membranes lining the stomach and intestines. At times this irritation is sufficiently great to cause diarrhea.

When fats reach the small intestine they are emulsified with bile, a secretion from the liver. This permits the lipase, steapsin, in the pancreatic juice to more effectively split up the tiny droplets into fatty acids and glycerol. The fatty acids are rendered soluble by the action of bile so that they may pass through the walls of the small intestines into the lacteals and thus into the general lymph circulation. The fatty acids recombine with glycerol in the lymph circulation and probably enter the general blood circulation by way of the thoracic duct in the neck.

The readiness with which fats are absorbed depends largely upon their melting points. Butter, for example, with a melting point of 75° F. is much more completely absorbed than a hard fat such as suet which melts at 95°-105° F. As a rule from 90 to 95 per cent of the fat eaten is absorbed. Mineral oils are not absorbed from the intestine.

Metabolism. Fats leave the blood and go into the tissues within a few hours after they have been absorbed from the intestines. The oxidation of the fats is more complicated than the oxidation of the carbohydrates. The liver has two important functions in fat metab-

olism. A fairly large part of the absorbed fat is changed by the liver into phospholipides which are carried by the blood for use by the active body tissues. A second role of this all-important organ is its ability to split the long carbon chains of the fatty acids into 4 carbon groups. These shorter chains are finally oxidized in the tissues to yield energy, carbon dioxide, and water as end products. The exact role of carbohydrates in the combustion of fats at this point is not now clearly known. Any excess fats will be deposited as adipose tissue, each living being building body fat which is characteristic of that species.

Daily Allowances. The amount of fat needed by the average adult is perhaps small from the standpoint of physiology, but it is well known that a more palatable diet results by allotting 25 to 40 per cent of the total calories required per day to fat. This nutrient cannot be substituted entirely for carbohydrate because unduly large breakdown of fats may exceed the body's ability to completely oxidize them and ketosis may result.

A number of unsaturated fatty acids such as arachidonic acid cannot be synthesized by the body or only to a limited extent. They must therefore be brought in by the food and are considered to be nutritional essentials. It is believed that linoleic and linolenic acids also belong to this group since they can be changed to arachidonic acid in the body. These essential fatty acids are widely distributed in plant and animal fats so that there is little danger of deficiency in the diet.

Fuel Value. Every gram of fat burned in the body will yield nine calories of heat, more than twice the amount other nutrients yield.

Sources. There are two sources of fats in foods—animal and plant sources.

Animal Sources. Butter and cream, cheeses made from whole milk, whole milk; egg yolk; beef suet, fatty meats, bacon, lard; fatty fish, such as salmon and fish preserved in oil; fat from poultry; fish liver oils.

Plant Sources. Margarine, nut butter, and other butter substitutes made from vegetable fats; salad oils from cottonseed, peanuts, cocoanuts, corn, and soybeans; olives, avocados, nuts, cocoanuts; chocolate. Plant oils such as cottonseed, corn, soybean, peanut, and olive oils are good sources of the unsaturated fatty acids.

Hydrogenated fats are those in which hydrogen has been added to unsaturated fatty acids to produce a solid fat. If their melting point is at or below body temperature they are readily digested. The margarines are examples of such fats. These butter substitutes compare favorably with butter not only in flavor and in energy value but also in their vitamin content if they have been enriched.

Cholesterol occurs especially in brain, liver, egg yolk, smooth muscle, and to some extent in skeletal muscle. Its occurrence may be of practical importance in certain disease conditions.

Disadvantages of an Excessive Fat Intake. Unduly large consumption of fat is unwise since the digestion of this nutrient is less easily handled than is that of carbohydrate, with the result that nausea, vomiting, and diarrhea may accompany excessive intake. When the amount of fat eaten exceeds the needs of the body, deposits of fat will occur not only as adipose tissue but also in the vital organs such as the heart, kidneys, and liver so that their efficiency is impaired. Long continued overeating of fatty foods leads to obesity which is so often a predisposing factor in many diseases of middle age.

Improper balance of carbohydrates and fats in the diet may lead to a type of acidosis known as ketosis, a complication sometimes occurring in diabetes mellitus (see Chapter XXVIII).

PROJECTS

1. Calculate the fat content of:
   a. 125 grams of white bread
   b. 30 grams of white bread with 5 grams of butter
   c. 1 glass (200 grams) of milk

2. Prepare an outline which shows the digestion, absorption, and metabolism of fats.

3. A diet contains 70 grams of protein, 125 grams of fat and 250 grams of carbohydrate. What percentage of the total calories in this diet come from fat?

REVIEW QUESTIONS

1. What is a fat? What elements does it contain? How does it differ from carbohydrate?

2. Name three fatty acids commonly found in foods.

3. Upon what factors does the hardness of a fat depend?

4. What is meant by an "unsaturated" fatty acid? Give examples.

5. What three types of fats are important in nutrition? Where are each found?

6. Name 8 functions of fat in the body. Why are phospholipides especially important?

7. What are 6 good sources of food fats of animal origin? Of plant origin?

8. What is meant by an essential fatty acid? Give an example of one.

9. What enzyme participates in the digestion of fats? Upon what does the absorption of fats depend?

10. What happens to the fats which are absorbed? What are the end products of fat metabolism?

11. What is the fuel value of fat?

12. What amounts of fat are desirable in the daily diet?

13. What conditions may occur if the fat intake is excessive?

14. What effect will the inclusion of fatty foods such as fried potatoes and pork chops have on the digestion of the meal as a whole?

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CHAPTER V

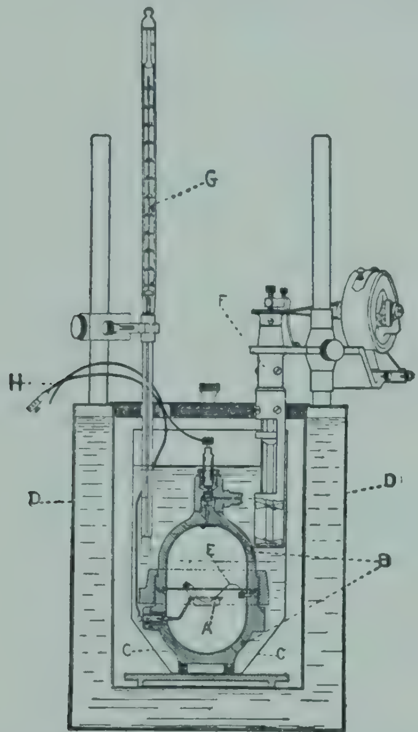
Energy Metabolism

Energy. The term "metabolism" is given to the chemical changes which take place in the active tissues of the body. It includes anabolism or the building of new materials from the end products of digestion, and catabolism or the oxidation of foods by the body tissues. The latter process usually designated as energy metabolism results in (1) a release of energy for the production of work, and (2) a liberation of heat for the maintenance of body temperature.

Every machine requires fuel of some sort in order to run. Experience has proved that just so much fuel is used by the machine with every revolution of its wheels and the faster they turn the more fuel the machine requires. So it is with the body; every movement, the turning of the head, clasping of the hands or the tightening of the muscles under excitement (muscle tone or tension), sets up internal activities which require energy—the more movement, the more energy required. When an engine stops, its use of fuel likewise stops; but this is not true with the body machine. No matter how hard one may try to keep still, the internal work of the body continues. Although the muscles seem to be relaxed, they are never completely so, even in sleep, for the muscles of the chest and diaphragm continue to rise and fall with breathing, the muscles of the heart contract and relax with the pumping of blood to carry nourishment through the body. Thus, there is never a time when the body is not using fuel (energy), and this must be furnished by the oxidation (combustion) of food. In other words, one must eat to live.

In order to understand the body's need for energy it will be necessary to know (1) how energy values are determined, (2) what factors affect the body's need for energy, and (3) how the daily requirement of an individual can be calculated.

Measurement of Fuel Values. The unit of measurement for energy or heat is called a calorie. The energy or caloric value of foods may be readily determined in the laboratory by means of an apparatus known as a bomb calorimeter illustrated in Figure 3.



Courtesy of the Emerson Apparatus Co., Boston, Mass., and M. S. Rose

Fig. 3. Diagram of Bomb Calorimeter with Bomb in Position
A. Platinum dish holding food sample.
B. Bomb filled with pure oxygen enclosing food sample.
C. Can holding water, in which bomb is submerged.
D. Outer double-walled insulating jacket.
E. Fuse, which is ignited by an electric current.
F. Motor-driven water stirrer.
G. Thermometer.
H. Electric wires to send current through fuse.

A sample of the food to be analyzed for its caloric value is dried and weighed carefully on an analytical balance. The sample together with a given amount of oxygen is sealed in a heavy steel container called a bomb. The bomb in turn is immersed in a vessel containing a known amount of water, and the whole apparatus is surrounded by insulated walls to prevent any loss of heat. The temperature of the water is taken with a thermometer which measures changes to $1/1000$ of a degree. When the temperature of the water is known the food sample is ignited by an electric spark and

quickly burned. The heat given off by the burning of the food is dissipated throughout the water and the temperature is again noted carefully. By determining the rise in temperature one can calculate the caloric value of the food, for by definition one calorie is the amount of heat required to raise the temperature of one kilogram of water one degree Centigrade.

In the calorimeter the food is completely burned (oxidized), but in the body there is some loss in digestion. The losses in digestion are carbohydrate, 2 per cent; protein, 8 per cent; and fat, 5 per cent. In the case of protein, losses in metabolism occur because the oxidation is not so complete as that of the other two nutrients. In estimating the fuel value of food, these losses have been taken into account. The results of many experiments have given us the fuel factors now in use. These are called "physiological fuel factors" and are as follows:

1 Gm. of pure carbohydrate will yield 4 calories
1 Gm. of pure fat will yield 9 calories
1 Gm. of pure protein will yield 4 calories

These three factors are used to calculate the energy furnished by these nutrients.

Method of Calculation. There are only a few foods which are composed of a single nutrient. Among them are sugar, which is 100 per cent carbohydrate; salad oils, which are 100 per cent fat; dry gelatin and dried egg white, which are 100 per cent protein. In dealing with these specific foods, 1 gram of sugar multiplied by its fuel factor 4 would yield 4 calories; 1 gram of salad oil multiplied by its fuel factor 9 would yield 9 calories; 1 gram of gelatin multiplied by its fuel factor 4 would yield 4 calories. On the other hand, most foods are composed of several nutrients. Suppose the food to be measured contains carbohydrates, fats, and proteins. To find the actual amounts of these nutrients, we must consult a table of food values. These values may be expressed in one of two ways, either as percentages or in grams. Percentage means parts in a hundred. It makes no difference whether the amount is expressed as grams, ounces, or pounds, 1 per cent of a hundred grams would be one gram, and 1 per cent of a hundred pounds would be one pound.

Milk, for example, has a composition of 4.9 per cent carbohydrate, 3.9 per cent fat, and 3.5 per cent protein. A 100-gram portion of milk would contain 4.9 grams of carbohydrate, 3.9 grams of fat, and 3.5 grams of protein:

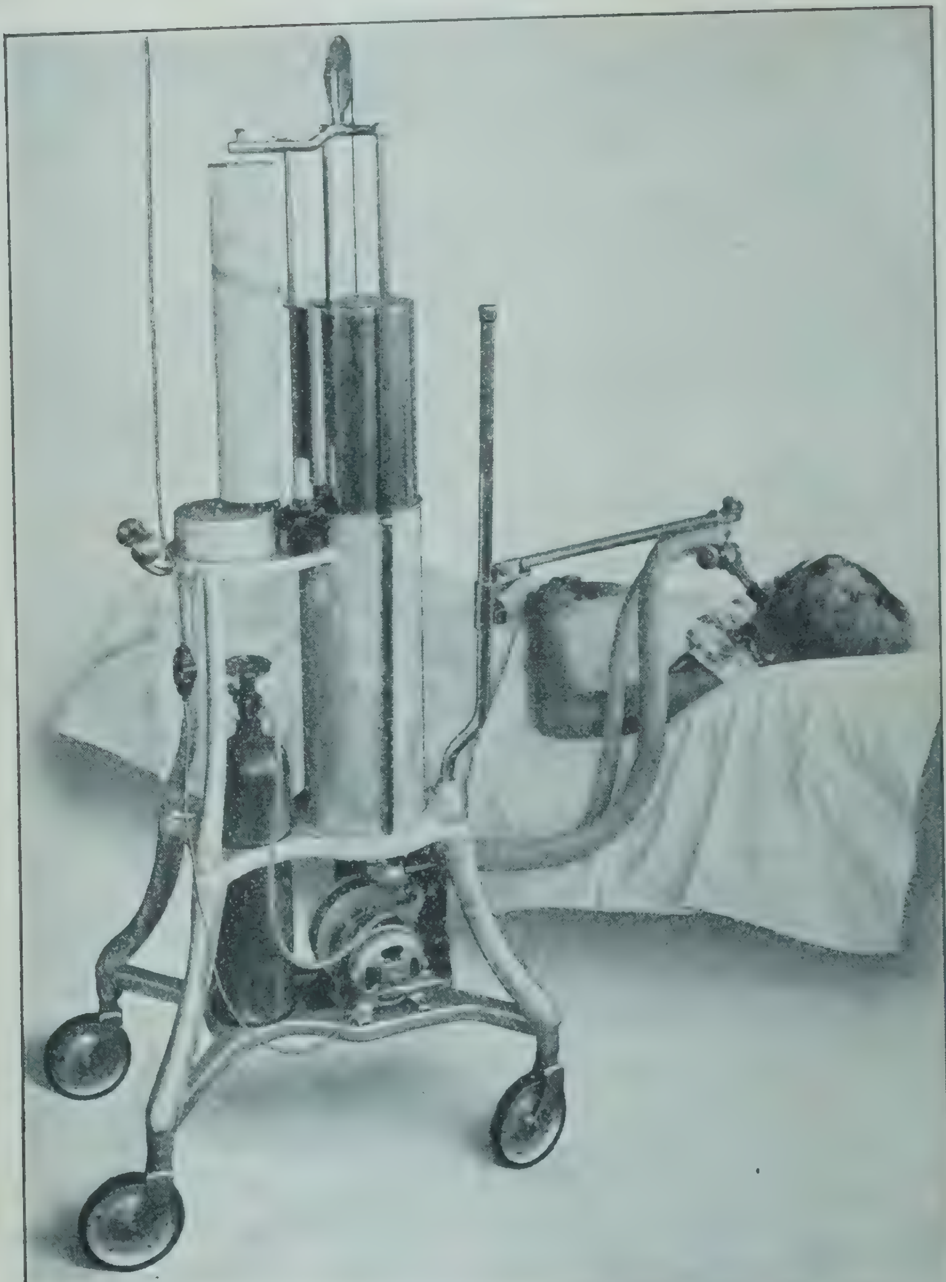
100 x 0.049 = 4.9 gm. carbohydrate x 4 (fuel factor)	= 19.6 calories from carbohydrate
100 x 0.039 = 3.9 gm. fat x 9 (fuel factor)	= 35.1 calories from fat
100 x 0.035 = 3.5 gm. protein x 4 (fuel factor)	= 14.0 calories from protein
	68.7

100 grams of milk will furnish 68.7 calories of heat.

All foods are calculated in the same way, no matter what the size of the portion or how many foods are to be calculated.

Estimation of Heat Production by the Body. It is possible to measure directly the amount of heat produced by the body under specified conditions by placing the individual in a large insulated chamber called a "Respiration Calorimeter". The heat given off can be estimated by noting the change in temperature of water flowing through coils in the walls of the chamber. Large calorimeters to accommodate an individual for several hours or even days are very expensive and have been possible only in a few research laboratories in this country. By means of them, however, it has been possible to determine the total metabolism of an individual under varying conditions.

A much simpler technique for measuring energy exchange is by means of the basal metabolism test. This test is a measure of the amount of energy which is necessary to carry on the involuntary work of the body. About one third of this energy is used to maintain the functional activities of the various organs such as the heart, kidney, and lungs, whereas the remaining two thirds of this energy will be needed for oxidation in the resting tissues especially in the maintenance of muscle tone. Oxygen is directly responsible for the production of energy from food or from the body tissues, since no combustion can occur without it. To determine the basal metabolism of the individual, therefore, it is necessary to measure the amount of oxygen consumed. Standard conditions for this



Courtesy of the Sanborn Company

Fig. 4. Respiration Calorimeter Testing the Basal Metabolism

determination require that the individual be physically and mentally relaxed in a comfortable environment. Furthermore he must not have partaken of food for 12 to 16 hours, and he must have a normal body temperature. The variation of an individual's basal metabolic rate is considered normal when it does not exceed 10 per

cent above or below the recognized standard for basal metabolism.

Factors Influencing the Basal Metabolic Rate. Basal metabolism is not the absolute minimum of energy required to run the body engine, since sleep will reduce the value by another 10 per cent, but it is the more convenient base line to use for it is not often possible to obtain the measurement during sleep. Several important factors will influence the rate of basal metabolism. These include size, shape, and weight of an individual, body composition, age, the influence of endocrine glands, and the state of nutrition.

Size, Shape, and Weight. The basal heat production for a given group of individuals is directly proportional to the surface area rather than to the weight. Let us suppose that two individuals weigh the same but one is tall and thin while the other is short and fat. It will be found that the tall thin person who has a greater surface area will have a higher basal metabolism than the short stout subject.

Body Composition. It is well to remember that the basal metabolism of individuals of the same weight and height is not always the same, due to the difference in the composition of their bodies. The rate of heat production will be greatest in those people who have the largest amount of active tissue in their bodies. Again a tall thin person with little deposits of fat tissue is expected to have a higher basal metabolism than the short stout individual of the same weight who has larger amounts of inactive adipose tissue. Athletes show about 5 per cent higher basal metabolism than nonathletic individuals. The higher rate of metabolism in men is believed to be due to the fact that as a general rule they have more highly developed muscles and less inactive fat tissue than women.

Age. The energy needs of adults during the middle years of life are not greatly affected by age; but in children during the period of rapid growth it is of great importance. The younger the individual, the higher his basal metabolism per unit of body weight, since much energy is stored for growth. The period when the basal metabolism reaches its highest level is between the ages of one and two years. There is a gradual decline from two to five years and a more rapid decline (except for the slight rise at the approach of puberty) until adult age is reached. During the middle years of life there is little change in the basal metabolic rate but a slight decrease occurs during old age, no doubt due to the fact that internal activities are

not as vigorous as they were in youth. Therefore, with approaching age and a slowing-down of the body activities, the food intake should be decreased, or there will be an increase in weight due to the storage of the unused fuel in the form of adipose tissue.

Influence of the Ductless Glands. Variations in the activity of the ductless glands, the thyroid in particular, exert a marked influence on the energy requirements. If the thyroid gland is overactive (hyperthyroidism), the metabolism will sometimes be speeded up as much as 100 per cent; if activity of the gland is decreased (hypothyroidism), the metabolism is likewise decreased. An increased metabolic rate may also be found in disturbances of the pituitary.

Effect of State of Nutrition. An individual who has been chronically undernourished shows a lower basal metabolic rate than one who has enjoyed optimum nutrition. Such findings are always common among people of famine-ridden countries following war or other pestilence.

Factors Affecting Total Energy Requirement. In addition to the basal metabolism, which represents the body's constant use of energy, we must recognize the importance of other factors such as voluntary muscular activity, temperament, environment, and the intake of food all of which increase the fuel needs and make it impossible to live on a basal level for any length of time. Hence, in our estimation of total energy requirements we must make allowances for both external and internal activities of the body.

Effect of Food. In addition to the food needed to provide energy for the internal work of the body and that which is required to cover the needs for muscular activity, a small increase must be allowed to cover the effect of food consumed. The extra heat which is produced after taking food is known as "specific dynamic action". Of all the food constituents, protein exerts the greatest stimulation of heat production and is said to have the highest specific dynamic action. The ingestion of a protein meal may increase the rate of metabolism by 30 per cent over the basal value for a period of a few hours. The average daily increase for a mixed diet is about 6 per cent of the basal metabolism.

Effect of Muscular Activity. Every movement, no matter how slight, increases the energy requirements of the body — the greater the muscular exertion, the more energy needed. For example, more

energy is needed to lie absolutely still in bed when food has been eaten than to lie absolutely still without food. More energy is needed when sitting still than when confined to bed — and so it is seen that muscular activity, either internal or external, is one of the most important influences in increasing the energy needs of the body. It is therefore necessary to know the amount and kind of muscular exercise, that is, the character of the work or occupation of the individual, in order to determine how much food he will require. Sedentary work, which includes office work, bookkeeping, typing, teaching, etc., calls for less energy than more active and strenuous occupations such as nursing, housekeeping, or paper-hanging. A still greater amount of energy is required by those individuals who do manual labor such as ditch-digging, shifting freight, and lumbering.

Influence of Temperament. Not infrequently the question is raised as to the reason for the differing food needs for two people of the same build and weight who are doing the same kind of work. The temperament of the individual is here the important factor since there may be great increases in muscle tension in those who are so frequently described as energetic and active. One person may waste many motions in the performance of a piece of work; he relaxes less during leisure hours; and he continuously works under greater muscle tension than another individual. The result is that his energy needs will be greater.

Pregnancy and Lactation. Pregnancy increases the energy needs to some extent to cover the building of new tissue, and lactation increases them to a marked degree because the work of manufacturing milk must be added to the normal energy needs of the mother.

Maintenance of Body Temperature. In the body, heat is set free as a result of both internal and external work; hence it is seldom necessary to supply extra food to maintain the body's normal heat or temperature (98.6° F.). The question is largely a matter of getting rid of any surplus heat produced. Heat is lost from the body in two ways: (1) by radiation and (2) by evaporation (sweating). When the body is warmly covered by adequate clothing and the surrounding air is comfortably heated, the heat loss is very little. As stated above, body heat is still further conserved if there is a layer

of adipose tissue under the skin. This subcutaneous fat serves to keep the heat in the body rather than allow it to be dissipated through the skin. Another way of maintaining body heat is through additional exercise. When the body is subjected to extreme cold, the muscles contract more vigorously in order to generate additional heat. This increase in the metabolic rate in response to cold is called "chemical regulation." Thus in very cold climates the character and amount of food taken may have to be adjusted to meet this increased metabolism; that is, the amount of heat-producing foods must be increased.

Calculation of the Energy Requirements of Adult Individuals. After the general discussion of the factors which affect the energy or caloric requirements of normal individuals, it is time to show how to calculate these requirements for a specific individual. Many experiments have been made to determine the amount of energy needed by the average adult per day under varying conditions. These experiments were made under close supervision where conditions could be controlled. M. S. Rose[1] has arranged the results of the experiments in a table to be used for calculating the energy needs of men and women based on the amount of energy needed per kilogram of body weight per hour.

The first step toward finding how much energy an individual needs per day is to find out what he should weigh for his height and age by consulting tables. Weight-for-height tables have been arranged by various life insurance companies and other authorities from a vast number of individuals. It is generally felt that the ideal weight for height at age 30 is the best weight to maintain for the rest of one's life. The height and weight tables in the Appendix (pages 735-6) may be consulted for calculations of energy.

After finding the proper weight for the individual according to his height and age, his energy needs may be calculated with considerable accuracy from the table on page 43, which takes into consideration muscular activities. If the character of the individual's occupation is known and some of the other factors which call for physical activity, and so influence his daily need for energy, are obtained, the calculation of his energy expenditures will be simplified. It is necessary to take careful note of the various types of work, play, and active exercise and to select the ones which most nearly

ENERGY EXPENDITURE PER HOUR UNDER DIFFERENT CONDITIONS OF MUSCULAR ACTIVITY[1]

Form of Activity	Calories per Hour			
	Man		Woman	
	Per Kilogram	Per Pound	Per Kilogram	Per Pound
Sleeping	0.93	0.43	0.87	0.40
Awake lying still	1.10	0.50	1.02	0.47
Sitting quietly	1.43	0.65	1.33	0.60
Reading aloud	1.50	0.69	1.39	0.63
Standing relaxed	1.50	0.69	1.39	0.63
Hand-sewing	1.59	0.72	1.47	0.67
Standing at attention	1.63	0.74	1.53	0.69
Knitting (23 stitches per minute on sweater)	1.66	0.75	1.54	0.70
Dressing and undressing	1.69	0.77	1.57	0.71
Singing	1.74	0.79	1.62	0.74
Tailoring	1.93	0.88	1.79	0.81
Typewriting rapidly	2.00	0.91	1.86	0.85
Ironing (with five-pound iron)	2.06	0.93	1.91	0.87
Dishwashing (plates, bowls, cups, and saucers)	2.06	0.93	1.91	0.87
Sweeping bare floor (38 strokes per minute)	2.41	1.09	2.24	1.02
Bookbinding	2.43	1.10	2.26	1.02
"Light exercise"	2.43	1.10	2.26	1.02
Shoemaking	2.57	1.17	2.41	1.10
Laundry work (towels rubbed on a board without water, 35 times per minute)	2.60	1.18	2.42	1.10
Walking slowly (2.6 miles per hour)	2.86	1.30	2.66	1.21
Carpentry, metal-working, industrial printing	3.43	1.56	3.19	1.45
"Active exercise"	4.14	1.88	3.85	1.75
Walking moderately fast (3.75 miles per hour)	4.28	1.95	3.99	1.81
Stoneworking	5.71	2.60	5.31	2.41
"Severe exercise"	6.43	2.92	5.98	2.72
Sawing wood	6.86	3.12	6.39	2.90
Swimming	7.14	3.25	6.64	3.02
Running (5.3 miles per hour)	8.14	3.70	7.57	3.44
"Very severe exercise"	8.57	3.90	7.97	3.62
Walking very fast (5.3 miles per hour)	9.28	4.22	8.63	3.92

resemble those of the individual for whom the estimation is to be made.

To make this problem practical, let us select a nurse who is twenty years old, weighs 124 pounds (about 56 kilograms), and is 5 feet 3 inches tall. Her energy requirements would be calculated as shown in the following table.

DAILY ENERGY REQUIREMENTS OF NURSE (CITED)

Occupation	Hours		Weight in Kilograms		Calories per Kilogram per Hour		Total Calories
Sleeping	8	×	56	×	0.87	=	390
Dressing	1	×	56	×	1.57	=	90
On duty, active	4	×	56	×	3.85	=	862
On duty, light	4	×	56	×	2.26	=	506
At meals (sitting quietly)	1½	×	56	×	1.33	=	112
In class (sitting quietly)	3	×	56	×	1.33	=	335
Recreation (active exercise)	1	×	56	×	3.85	=	216
Studying (sitting quietly)	1½	×	56	×	1.33	=	112
Total calories needed in twenty-four hours							2,623

It is not always possible to have so full a table available for calculating the energy needs of average individuals; hence, the following table, arranged by M. S. Rose, is offered for general use as it is easily remembered.

DAILY ENERGY ALLOWANCE PER UNIT OF BODY WEIGHT FOR YOUNG AND MIDDLE-AGED ADULTS

1. Complete rest	25 calories per kg. of body weight per day
2. Bed rest	30 calories per kg. of body weight per day
3. With light exercise	35–40 calories per kg. of body weight per day
4. With moderate exercise	40–45 calories per kg. of body weight per day
5. With hard muscular labor	45–50 calories per kg. of body weight per day

Energy Requirements of Children. The energy allowances for children are necessarily higher per kilogram of body weight than those for adults. This is because growth and development during the period from birth to maturity make far greater demands for energy than does the maintenance of the already complete body

structure of the adult. Different periods of growth likewise differ in the demand for energy. Children even of the same age, height, and weight may differ widely in their energy needs, depending largely upon their degree of activity. The energy requirements of children, together with the requirements for building and regulating their body processes, will be discussed in detail in Chapter XVII, "Feeding Children."

Gain or Loss in Body Weight. If the energy requirements of the body are balanced daily by the intake of energy-producing foods, there should be little, if any, change in body weight from the general average weight of the individual according to his height and age. If, however, the intake of food exceeds the body's needs, the excess energy furnished by the food will be stored in the body as fatty tissue, and the individual will gain in weight. A condition of marked overweight or underweight is undesirable — "pronounced underweight before the age of twenty-five is an unfavorable condition as it is often associated with a lack of resistance to pulmonary affections and other diseases of youth. After the age of thirty underweight, unless extreme, is not an unfavorable condition."[2] The tendency of youth to keep too thin and the tendency of those past the age of forty years to put on too much fat should be recognized and guarded against. In children the demand for energy made by growth is an important factor in supplying the right kind and amount of food. Any excess energy will be stored as growth in new tissues.

Selecting Foods Which Supply Energy. It is not possible to state the amount of food which is necessary without mentioning the kind of food to be used to cover the energy requirements of the body, since foods differ in their energy or calorie value as shown above. One food may be very rich in fat, thereby furnishing much energy, while another food will be low in fat or fat-free and will furnish much less energy if used in the same quantity. A pound of butter, for example, being rich in fat, will produce 3491 calories; a pound of bread, low in fat (though rich in carbohydrates), will furnish only 1192 calories.

In the planning of the daily diet it is well to remember that one should first include the necessary amount of protein, minerals, and vitamins. The caloric requirement can be met by selecting any

foods desired. It will be remembered from preceding chapters that foods which contain a high proportion of fat or of carbohydrate are high in calories and low in bulk. Maintenance of normal weight in the adult, or a satisfactory rate of gain in the child, are the best indications that caloric intake is suitable for body needs.

SUMMARY

1. The calorie is the unit of measurement for energy production by the body, or for energy value of foods.

2. The caloric value of foods may be determined in a bomb calorimeter.

3. The minimum energy metabolism of an individual is estimated by means of a basal metabolism test which measures the amount of oxygen consumed under the following conditions: (1) the subject is physically and mentally relaxed in a comfortable environment; (2) no food has been eaten for 12 to 16 hours; (3) the body temperature is normal.

4. Factors which affect the basal metabolic rate are surface area of the body, amount of active body tissue, age, secretion of endocrine glands, and state of nutrition.

5. Total energy metabolism is the amount of heat production resulting from involuntary and voluntary work of the body. It is the sum of the basal metabolism plus the influences of muscular activity, ingestion of food, temperament, growth, environment for maintenance of body temperature, and pregnancy and lactation.

PROJECTS

1. Calculate your own energy requirements according to the method cited on page 42. Compare your estimation with the result obtained by using the short table on page 44.

2. Calculate the number of grams required of each of the following foods to furnish 100 calories: butter, milk, cheese, egg, potato, apple, banana, orange, sugar, bread, and lean beef.

3. On the basis of protein, fat, and carbohydrate composition calculate the fuel value of

240 grams milk
160 grams orange
20 grams dry oatmeal

Show all steps in the calculations.

4. Calculate the caloric value of your own meals for one day.

REVIEW QUESTIONS

1. Define or explain what is meant by:
   a. Calorie
   b. Basal metabolism
   c. Bomb calorimeter
   d. Respiratory calorimeter

2. Explain the effect that each of the following may have on basal metabolism: age; surface area; endocrine secretions; food; sleep; muscular development.

3. Explain how these factors affect the total energy requirement of an individual: muscular activity; food; climate; clothing; growth; muscle tension; endocrine secretions.

4. What is the approximate daily requirement for calories for a nurse? A man working in an office? A soldier engaged in strenuous activity? A patient without a fever lying quietly in bed? A boy 16 years of age?

5. What is the best indication of adequate caloric intake?

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CHAPTER VI

Mineral Elements

Certain important body requirements such as the building and upkeep of bones and teeth and the regulation of body processes cannot be supplied by protein, fat, and carbohydrate alone. New bone and tooth tissue must be built during prenatal life and throughout childhood until the structures are of adult size and permanence. Small daily losses of material (wear and tear quota) from the bones and teeth must be replaced.

Every machine, no matter how simple in character, requires some regulation; and so it is with the body. The activities of the organs, the response of the muscles and nerves, the passage of fluids in and out of the body tissues represent a few of the processes in need of regulation. Minerals, vitamins, water, and cellulose together with protein supply the body with essential regulatory materials. The important mineral elements will be discussed in this chapter.

Definition. Minerals may be defined as those elements which remain largely as ash when food materials are burned. They occur in foods and in the body both in organic and inorganic combinations. For example, sodium and chlorine exist as an inorganic compound, while iron and phosphorus may occur in such complex organic materials as hemoglobin and phosphoproteins, respectively.

Occurrence in the Body. Four chemical elements compose about 96 per cent of the body weight. They are:

	Per cent
Oxygen	65
Carbon	18
Hydrogen	10
Nitrogen	3

The remaining 4 per cent of the body weight is made up of the elements usually designated as minerals. It is obvious, then, that the amount of an element present gives no clue to its importance in

body functions. It will be shown, for example, that a few milligrams of an element such as iodine can make a critical difference in the health of an individual.

While most of the elements in the body have definite and specific functions, it is not known whether some of those occurring in minute quantities are present for some role in body metabolism or whether they are merely contaminants. Certain minerals are present in such small amounts that they are designated as "trace elements." The following chemical elements are associated with mineral metabolism in the body:

	Trace Elements
Calcium	Iodine
Phosphorus	Copper
Magnesium	Manganese
Potassium	Zinc
Sulfur	Fluorine
Sodium	Cobalt
Chlorine	Silicon
Iron	

Functions. Minerals enter to a greater or lesser degree into the structure of all body tissues. The hard skeletal structures are largely composed of them, but it is equally important to realize that the nuclei of soft tissues such as nerve and muscle cells contain mineral matter.

Of vital importance is the part played by minerals in regulation of the body's functions. The contraction of muscles, the irritability of nerves, the control of water balance, the maintenance of acid-base equilibrium, and the utilization of foodstuffs are but a few of their numerous functions.

The Problem of Optimum Mineral Intake. For the normal adult a state of equilibrium is usually desirable with respect to the minerals; that is, the intake should equal the amount which is excreted. The minerals are eliminated by various routes; namely, the kidney, the bowel, and the skin. Some are excreted by all three routes while others may be lost primarily from the kidney or the intestine. It has been estimated that about one fourth of the solid material of urine consists of minerals, and that about one tenth of the solid material of feces is mineral matter.

During growth, pregnancy, and lactation it is necessary that the intake of certain minerals be sufficient to allow for the building of new tissue, or in other words, that a state of positive balance exist.

Calcium is the mineral most often deficient in the American dietary while iron ranks second in the frequency of low intake. In certain parts of the country iodine intakes may also be dangerously low. It is well known that other minerals will be supplied in adequate amounts if calcium, iron, and iodine are sufficient. Special consideration will then be given to these three minerals with only a brief discussion of the other equally important but seldom deficient minerals.

Not only is the amount of minerals ingested of importance, but the availability to the body is deserving of special attention. For example, no matter how high the intake of iron is, little benefit will be derived unless that iron is in usable form. Contrary to earlier opinions, it is becoming apparent from experimental work that inorganic mineral compounds are usually more readily utilized than organic substances.

In the selection of foods one should therefore keep four points in mind: (1) the richness of the mineral in the food; (2) how much of the particular food is to be used; (3) whether the food has lost some of its minerals through refinement or cooking processes; and (4) whether the food contains the mineral in an available form.

CALCIUM

Functions. Calcium is by far the most abundant mineral element in the body. It is also most likely to be low in the American dietary. About 99 per cent of this mineral occurs in combination with phosphorus as calcium phosphate to give hardness to the bones and teeth. The remaining 1 per cent is responsible for a variety of functions. Its presence in proper proportions with sodium and potassium is necessary in the fluids which bathe the tissues and are responsible for their contraction; the rhythm of the heart beat is dependent on this fluid medium. Calcium is one of the factors in blood coagulation, in normal response to nervous stimuli, and in the efficient utilization of iron.

Sherman[1] has shown that an adequate intake of calcium leads

to greater vitality and size of experimental animals, and that this improvement results in a longer prime of life. It is reasonable to suppose that such benefits will accrue to human beings as well if the calcium intake is optimum (see Fig. 5).

Daily Allowances. Optimum utilization of calcium is dependent upon the presence of adequate amounts of phosphorus and vitamin D. Sherman has found from 97 experiments that the average adult can maintain calcium balance with intakes varying from 0.27 to 0.82 Gm. daily, the average being 0.45 Gm. To allow for individual variations and a factor of safety the Nutrition Committee of the National Research Council[2] has placed the daily need at 0.8 Gm.

The needs for growing children are much greater since allowance must be made not only for increased skeletal size but also for increased skeletal hardness. Those children whose bodies are calcium-poor will show greater retentions of calcium when receiving adequate diets, than will children who are more adequately nourished.

The demands for the pregnant woman are even greater, being about twice as much as during normal adult life. Inadequate calcium in the diet is at the expense of both the mother and the child. During lactation it is necessary to include two and one half times as much calcium as for the normal woman.

DAILY ALLOWANCES OF CALCIUM[2]

	Gm.
Adult man	0.8
Adult woman	0.8
Pregnant woman	1.5
Lactating woman	2.0
Children, 1–9 years	1.0
Children, 10–12 years	1.2
Boys, 13–20 years	1.4
Girls, 13–15 years	1.3
Girls, 16–20 years	1.0

Foods Which Supply Calcium. No food can take the place of milk since its content of calcium is higher than that of other foods and the availability of the calcium is excellent. It does not matter whether milk be whole or skimmed, sweet or buttermilk, the calcium content remains quite constant. One pint of milk daily for the

adult and one quart for the child will insure an adequate intake of this mineral. One ounce of cheddar cheese may be substituted for one cup of milk. This list gives the calcium content of average serving portions of foods which are high or relatively high in calcium.

	Household Measure	Weight Gm.	Amount of Calcium Gm.
Milk	1 glass	200	0.24
American cheese	1 ounce	30	.26
Turnip tops	½ cup	100	.25
Egg, whole	1	50	.03
Egg yolk	1	17	.03
Kale	½ cup	100	.23
Broccoli	2 stalks	100	.13
Cabbage	½ cup	100	.05
Collards	½ cup	100	.25
Clams	6 medium	100	.11
Almonds	1 ounce	30	.08

The calcium content of certain greens as spinach and beet tops is high but the presence of oxalic acid makes it poorly utilized.

Effect of Calcium Deficiency or Excess. A deficiency of calcium in children leads to stunted growth and rickets as evidenced by bowing of the legs, enlargement of the ankles and wrist, and a hollow chest. While deficiency may not be apparent for a long time in adults it may eventually provoke osteoporosis or osteomalacia. If the intake of calcium is greater than the body's need for it, the excess will be excreted largely from the bowel.

PHOSPHORUS

Phosphorus ranks next to calcium in the total amount of mineral present in the body. It constitutes about one fourth of all body minerals, approximately 70 per cent of it being combined in bone structures with calcium. Phosphorus is necessary for (1) building of normal bones and teeth; (2) maintenance of the buffer system; (3) metabolism of carbohydrates and fats; and (4) cell movement and cell multiplication.

Approximately one and one half times as much phosphorus as calcium is needed in the diet in order that optimum utilization of

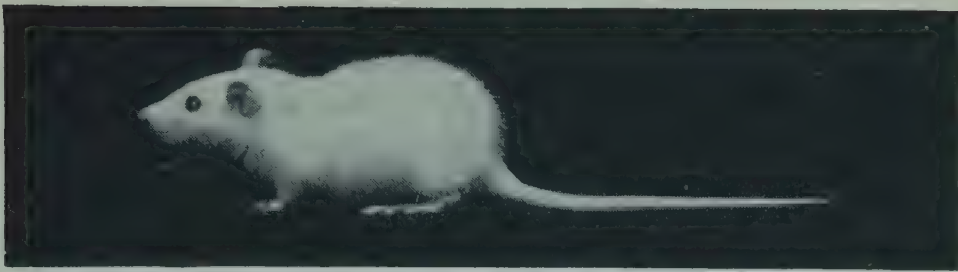
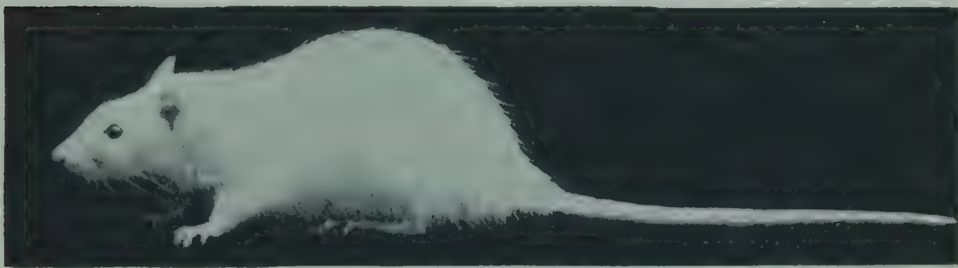


FIG. 5*a*. INSUFFICIENT CALCIUM IN AN OTHERWISE ADEQUATE DIET



Courtesy of Bureau of Home Economics, U. S. Dep't of Agriculture

FIG. 5*b*. SUFFICIENT CALCIUM ADDED TO MAKE THE DIET ADEQUATE
Litter mates of the same sex, 22 weeks old. Weight of smaller, 91 grams; of larger, 219 grams.

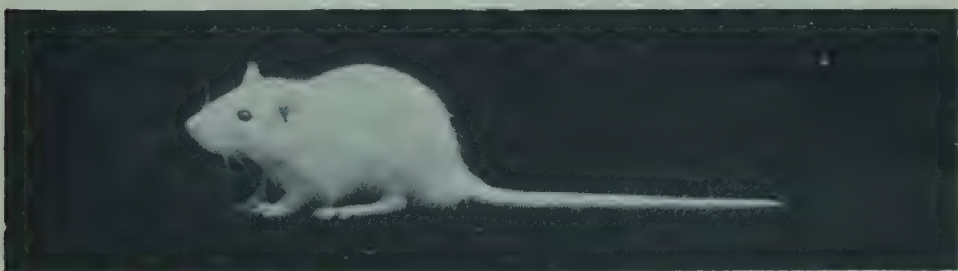
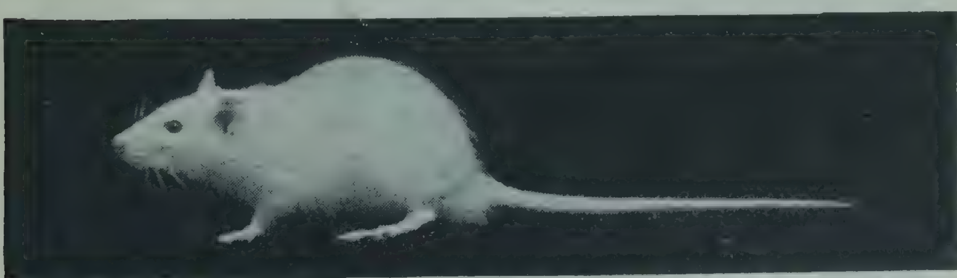


FIG. 6*a*. INSUFFICIENT PHOSPHORUS IN AN OTHERWISE ADEQUATE DIET



Courtesy of Bureau of Home Economics, U. S. Dep't of Agriculture

FIG. 6*b*. SUFFICIENT PHOSPHORUS ADDED TO MAKE THE DIET ADEQUATE
Litter mates of the same sex, 9 weeks old. Weight of smaller, 60 grams; of larger, 115 grams.

both minerals can take place. The demands are increased during growth, pregnancy, and lactation. The daily need of this mineral is about 1.5 Gm. for the growing child, while a level of 1.3 Gm. is satisfactory for the adult. However, deficiency of this mineral is not apt to occur if the calcium and protein intakes are adequate.

Excellent food sources of phosphorus are milk, cheese, egg yolk, meats, nuts, whole grain cereals, and green vegetables.

IRON

Functions. The amount of iron present in the adult body is a little more than the weight of a penny. Heath[3] has estimated that in the adult body approximately 2.7 Gm. of iron are to be found in the circulating blood, 0.3 Gm. is necessary in bone and other vital tissue, and about 1.3 Gm. may be stored.

The chief function of iron is as a constituent of hemoglobin where its presence makes possible the transportation of oxygen to the tissues. Our knowledge of the metabolism of iron is still very incomplete but it is known that the body exercises amazing economy in its use. When the red blood cell has fulfilled its life cycle of perhaps 100 days or a little less, the worn out cell is broken down by the liver so that the iron may be saved for new hemoglobin. There is definite proof that actual excretion of iron is extremely small; the urinary loss is negligible whereas iron which is eliminated from the bowel represents that which has never been absorbed at all.[4] In other words, the mineral is essentially a one-way substance which is used over and over again once it has been absorbed from the intestine.

Availability of Iron. The important factor to consider in the daily dietary is the availability of the iron, or the amount which can be absorbed from the intestine. Specific knowledge of availability of iron is still meager, but some nutrition workers[4] feel that as little as 10 per cent of the iron of the average daily diet may be actually absorbed from the intestine. Inorganic salts are more readily absorbed than organic compounds, and ferrous salts are more effective than ferric salts. Absorption of iron takes place more readily in an acid medium since these salts are soluble in acid solution. It seems likely that most of the absorption of this mineral will take place from only a small portion of the intestine; namely, the duode-

num and upper jejunum. Other factors such as sufficient intake of calcium, vitamin D, and ascorbic acid are known to promote efficient utilization of iron.

Daily Allowances. In order to effect an adequate absorption of iron it is necessary to supply in the diet these amounts as recommended by the Nutrition Committee of the National Research Council.[2]

DAILY ALLOWANCES OF IRON

	Mg.
Adult man or woman	12
Pregnant or lactating woman	15
Children—	
Under 1 year	6
1–3 years	7
4–6 years	8
7–9 years	10
10–12 years	12
Boys and girls—13–20 years	15

Effect of Deficiency. An inadequate intake of iron by growing children or by women, especially during pregnancy and lactation, will produce nutritional anemia since the stores of iron in the body are not sufficient to take care of the expanding blood volume of children or the increased requirements for blood building in women. Nutritional iron deficiency may also occur even though the intake is adequate, if there is faulty absorption because of gastric anacidity or diarrhea. A detailed discussion of anemias will be found in Chapter XXXIII.

Food Sources of Iron. All varieties of liver except fish livers have been found to be extremely potent sources of the blood regenerating factors. Certain fruits as peaches, apricots, prunes, grapes, and raisins are excellent sources of available iron. Then too, valuable contributions to the iron in the diet are made by molasses, skeletal and organ meats, egg yolk, some green leafy vegetables, and whole grain cereals.

IODINE

Function. Many centuries ago it was discovered that eating seaweed or the residue of burned sponges was effective in the treatment

of goiter. It was not realized that lack of iodine was responsible for the occurrence of goiter until 1895 when Baumann discovered the presence of this mineral in the thyroid gland. Certainly the amount of iodine present in the body gives no indication of its importance, for there are approximately 25 to 50 mg. in the adult body. About two fifths of it is in the thyroid gland, the rest of it being distributed in all body tissues — muscles, skin, bones. Iodine is an essential part of the thyroxin molecule, the primary function of which is the regulation of energy metabolism.

A lack of iodine brings about stunted growth in young children. Its deficiency also leads to a lowering of the metabolic rate, and

Courtesy of Dr. E. C. Kendall

FIG. 7. RESTORATION OF GROWTH IN A GIRL UPON TREATMENT WITH THYROXIN
The two photographs were taken in the same dress at an interval of six months.

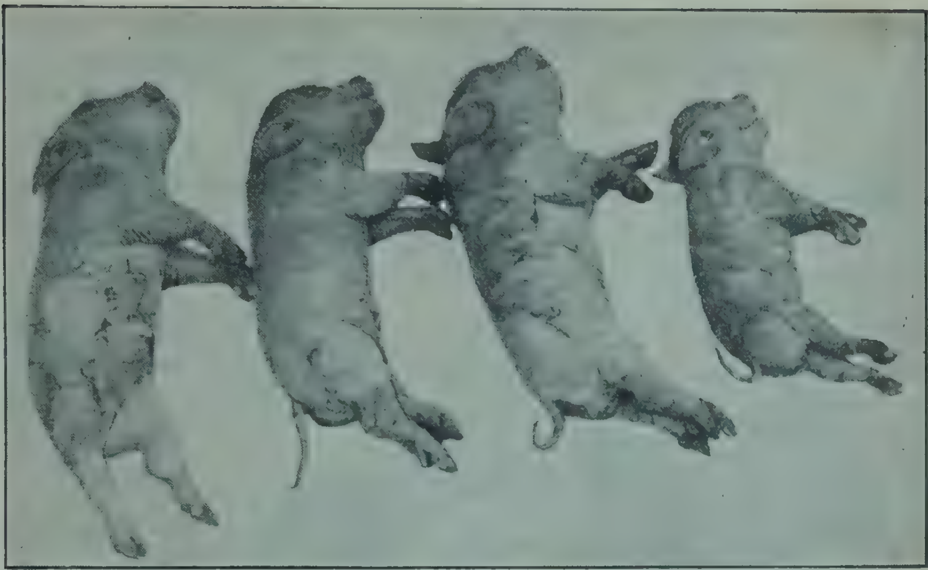
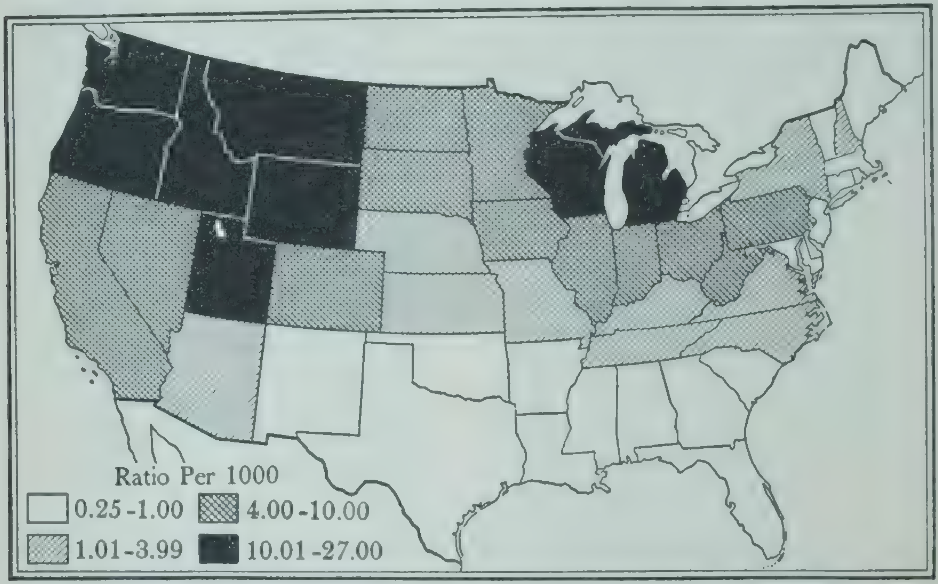


FIG. 8*a*. HAIRLESS PIGS
Condition due to iodine deficiency.

Courtesy of Dr. E. B. Hart, University of Wisconsin

FIG. 8*b*. MOTHER OF ABOVE PIGS
Condition corrected by addition of potassium iodide to the diet.

the enlargement of the thyroid gland to produce the condition known as simple goiter. Cretinism is the result of a congenital degeneration of the thyroid in very young children; marked deficiency of iodine always exists. This disease produces a decidedly stunted growth, and inhibits development of the central nervous system so that idiocy or feeblemindedness results. Thyroid extract given under the supervision of a physician is sometimes successful in the treatment of this condition.



Courtesy of Dr. J. F. McClendon, University of Minnesota, now of Hahnemann Medical College and Hospital, Philadelphia, Penn.

Fig. 9. Map showing ratio of simple goiter per 1,000 men examined for military service in each State of the United States during the First World War. The rates are based on a total of 2,510,701 examinations. (Olesen, Robt., U. S. Public Health Repts., 1927, p. 3180.)

The studies of Marine and Kimball[5] on school girls in Akron, Ohio were striking. They studied the incidence of goiter in the girls for a period of two and a half years and found 495 cases among 2305 girls who received no supplementary iodine, but only 5 cases among 2190 girls who received sodium iodide in the water.

Daily Allowances. The need for iodine is about 0.15 to 0.30 mg. daily for the adult. Deficiency is most likely to occur in growing children, and during pregnancy and lactation. Goiter prevails in some areas of the world because soils which are iodine-poor will produce foods which contain insufficient amounts of iodine. These "goiter belts" are in such widely scattered regions as the states

around the Great Lakes, the Pacific Northwest, Switzerland, and New Zealand.

Several methods have been proposed for insuring adequate intake of iodine. The addition of iodine to the drinking water of cities does not reach the large rural population. The distribution of tablets to school children is not entirely effective in that the two groups who particularly need iodine, namely, the pregnant or lactating women, and the preschool children, do not receive them. However, the use of iodized salt should be universal. There is no conclusive evidence that its use in any instance will prove harmful. The usual concentration is about 1 part sodium or potassium iodide in 5000 parts sodium chloride. Foods cannot be depended upon for their iodine content since their source is so variable.

OTHER MINERALS

Sulfur. Sulfur is a constituent of certain compounds which are very important in body metabolism — glutathione and insulin, for example. It is a component of hair and nails as well. This mineral is present in the amino acids cystine and methionine. A diet adequate in protein will supply sufficient sulfur for the body.

Sodium Chloride. The diet supplies sodium and chlorine in liberal quantities both in natural foods and as common table salt. Sodium is important in buffer salts, while chlorides are essential components of gastric juice and body secretions. Sodium chloride is one of the many factors in the maintenance of osmotic pressure. The normal daily diet may supply 6 to 15 Gm. of salt, whereas the minimum need is about 2 Gm. Excess salt is excreted in the urine and perspiration. Increased intake is necessary during periods of excessive perspiration, diarrhea, or certain endocrine disturbances since a depletion of salt in the body may lead to marked digestive disturbances.

Magnesium. Little is known about the exact needs of the body for magnesium. It is a necessary constituent of bones and teeth. Deficiency of this mineral leads to increased nervous irritability, rapid heart beat, and dilatation of the blood vessels.

Potassium. One of the important minerals in the soft tissues of the body is potassium. It aids in the maintenance of intracellular

fluid balance and helps to regulate muscular and nervous irritability.

Trace Elements. Manganese, cobalt, zinc, fluorine, selenium, copper, and aluminum occur in extremely small amounts in the body. Little is known about the functions of some of them. The daily requirement, however, is no doubt easily met when the diet is otherwise adequate.

Copper is unquestionably essential for the utilization of iron in the building of hemoglobin. The Nutrition Committee of the National Research Council[2] has stated the daily need for copper as 0.05 mg. per kilogram of body weight in children, while the adult needs one to two mg. The normal diet contains ample amounts of copper. *Cobalt* is also necessary in small amounts for the blood forming centers.

Animal experiments have shown that adequate *manganese* is essential for hormone activity, normal reproduction, and calcium-phosphorus metabolism.

Fluorine is an element which may be dangerous in excess, but essential in minute quantities since its presence in proper concentrations appears to minimize the occurrence of dental caries. Excess fluorine results in permanent mottling and staining of the teeth. The drinking water of certain communities in some of the western states contains fluorine in such quantities that the frequent occurrence of tooth disfigurement constitutes an important public health problem.

Some soils contain relatively large proportions of the dangerously toxic *selenium*. Excessive ingestion may lead to stunted growth, emaciation, loss of hair, cirrhosis of the liver, and decreased reproductive ability. No nutritive role has yet been found for this mineral.

ACID-BASE BALANCE

One of the very important functions of minerals is the maintenance of the acid-base balance of the body. Without this regulation it would be impossible to carry on the manifold functions of the body. The acid-base equilibrium is ultimately influenced by the food we eat.

The Reaction of Foods. Sodium, potassium, calcium, and magnesium are alkaline, while phosphorus, sulfur, and chlorine are acid.

If the alkaline elements in a food are in excess of the acid elements, that food will yield an alkaline ash in the body after metabolism has taken place. Vegetables, fruits, and milk contain a preponderance of alkaline elements and hence are base-forming. On the other hand, meat, eggs, and cereals with their quantities of sulfur and phosphorus are acid-forming.

It would seem that certain foods such as lemons, oranges, and other tart fruits would be acid-forming in the body, but such is not the case. Their tartness is due to the presence of various organic acids which are completely oxidized in the body to carbon dioxide and water. Of the minerals present in these foods, the basic elements predominate so that an alkaline ash results after metabolism. There are some exceptions, however. Plums, cranberries, and prunes contain benzoic acid which cannot be broken down in the body; as a result these fruits produce an acid reaction.

The alkalinity or acidity of a food can be stated in terms of the amount of normal acid or alkali to which it is equivalent. These values are listed in Tables V and VI in the Appendix (pages 731-2).

The Regulation of Body Neutrality. The reaction of the blood and body tissues is expressed by the symbol pH which denotes the concentration of hydrogen ions, or the relation between the acid and alkaline elements. Exact neutrality is designated as pH = 7. Water, for example, has a pH of 7. An alkaline reaction is expressed as a pH higher than 7 while an acid reaction is indicated by a pH lower than 7. The pH of the blood in health is in the narrow range of 7.3 to 7.5; in other words, the blood is very slightly alkaline. If the pH of the blood goes much below 7.3 an acidosis exists, while a pH above 7.6 indicates alkalosis.

This narrow range of reaction in the body is maintained by several remarkably sensitive mechanisms. Certain mixtures called *buffers* consist of weak acids and weak bases which can react with a large amount of acid or alkali without any significant change in the final reaction. The carbonic acid and alkaline carbonate system (chiefly sodium bicarbonate) is one of the fundamental means of maintaining neutrality, and constitutes the *alkaline reserve* of the body. Sodium and potassium are the most important elements for building up the alkaline reserve. Serious disturbances may occur if the alkaline reserve is depleted to any extent. (*Continued on page 65*)

SUMMARY OF THE MINERALS

MINERAL	FUNCTIONS IN THE BODY	EFFECT OF A DEFICIENCY	ELIMINATION OF EXCESS	FOOD SOURCES	DAILY ALLOWANCES
Calcium . . .	Build bones and teeth Blood coagulation Normal heart rhythm Muscle contraction Nerve irritability Aid in use of iron Related to vitality and longevity	Bones and teeth poorly developed Stunted growth Rickets Inadequate blood coagulation Osteoporosis	Feces; small amount in urine	*Best* Milk Hard cheese *Good* Clams Egg yolk Nuts Soybeans Broccoli Cauliflower Cabbage Mustard greens Turnip tops	Children: 1 to $1\frac{1}{2}$ grams depending on age Adults: 0.8 Gm. Pregnancy: 1.5 Gm. Lactation: 2.0 Gm.
Iron	Constituent of hemoglobin which carries oxygen to the tissues Constituent of bone	Decreased hemoglobin formation and resultant anemia Low vitality	Unabsorbed iron eliminated by intestine Absorbed iron is used over and over again	*Best* Liver *Good* Peaches Apricots Prunes Raisins Grapes Apples Meat Legumes Molasses Egg yolk Some vegetables	Children: 6 to 15 mg. depending on age Adults: 12 mg. Pregnancy or lactation: 15 mg.

Iodine	Constituent of thyroxin which regulates rate of energy exchange	Simple goiter or enlargement of the thyroid gland Low rate of metabolism Stunted growth	Urine	Iodized salt is best protection Sea foods and foods grown in non-goitrous regions	Adults: 0.15 to 0.30 mg.
Phosphorus .	Build bones and teeth Buffer salts Metabolism of fat and carbohydrate Cell multiplication Cell activity Activation of enzymes	Poorly developed bones and teeth Stunted growth Rickets	Urine; about $\frac{1}{3}$ is lost in feces	Milk Cheese Egg yolk Meat Legumes Whole grain cereals Nuts Vegetables	Children: 1.5 Gm. Adults: 1.3 Gm.
Potassium ..	Maintain intra-cellular fluid balance Regulate nervous and muscular irritability		Urine; some may be eliminated in perspiration	Vegetables Cereals Fruits	Diet adequate in protein, calcium and iron will contain enough potassium
Sodium	Regulate osmotic pressure Buffer salts Maintain water balance Muscle and nerve irritability	Digestive disturbances Poor water retention	Urine; some in perspiration	Table salt Meat Milk	At least 2 grams NaC1 daily Increased needs in excessive perspiration, diarrhea, certain endocrine disturbances
Chlorine ...	Regulate osmotic pressure Constituent of digestive juices Enzyme action Maintain electro-neutrality	Achlorhydria Digestive disturbances Poor water retention	Urine; some in perspiration	Salt	

SUMMARY OF THE MINERALS (continued)

MINERAL	FUNCTIONS IN THE BODY	EFFECT OF A DEFICIENCY	ELIMINATION OF EXCESS	FOOD SOURCES	DAILY ALLOWANCES
Sulfur	Development of hair and nails Constituent of insulin and glutathione	Disturbance of oxidation of foods Poor development of hair and nails	Urine	Eggs Cheese Meat Milk Nuts Legumes	Diet adequate in protein will contain enough sulfur
Magnesium	Constituent of bones and teeth	Nervous irritability Rapid heart beat Dilation of blood vessels	Urine	Cereals Meat	Diet adequate in protein, calcium, and phosphorus will contain enough of these minerals Exact requirements are not known
Cobalt	Normal hemoglobin regeneration			Liver Pancreas Sea foods Cereals, whole grain Legumes Vegetables	
Manganese	Normal growth and reproduction				
Copper	Utilization of iron for hemoglobin formation	Retardation of hemoglobin production		Liver Nuts Legumes Meat Fruits Vegetables Whole grain cereals	Children: 0.05 mg per kg of body weight Adults: 1.0 to 2.0 mg

Whenever foods are metabolized in the body, acid and basic elements are released. The acid elements may be combined at once with the alkaline elements present in the same food, thereby forming neutral salts. If, however, insufficient alkaline elements are present in the food, the reserve of alkali in the body will be called upon for neutralization of the acid.

Proteins are among the very important amphoteric substances since they can neutralize either acids or bases. For instance, hemoglobin is a means of transporting large amounts of carbonic acid to the lungs without any appreciable change occurring in the alkalinity of the blood. Serum proteins are equally important as buffers.

The kidney possesses the ability to excrete excess quantities of acids or alkalies, and the urine is an index to the reaction of a diet. If the diet is definitely acid, the urine will be acid, while a diet yielding an alkaline ash will result in an alkaline reaction of the urine.

It is thus seen that body neutrality, which is so vital, is regulated partially by the blood proteins, sodium and potassium buffer mixtures, and the carbonic acid-bicarbonate system. The role of the lungs and the kidneys in the excretion of excess acid products cannot be overemphasized.

PROJECTS

1. Plan a diet for a student nurse which contains sufficient calcium without the use of milk or cheese. List the amounts of food and calculate the calcium content.
2. Calculate your daily intake of iron for two days.

REVIEW QUESTIONS

1. What are the relative amounts of calcium, phosphorus, iron, and iodine to be found in the body?
2. Name 5 important common functions of minerals in the body.
3. Name 3 functions of calcium in the body.
4. What is the best source of calcium? What are other fair sources of calcium?
5. What is the daily requirement of calcium for a nurse?
6. What factors will increase the need for calcium?
7. What is the result of a deficiency of calcium in the diet?
8. What are the important functions of phosphorus?

9. If the diet supplies enough calcium, iron, iodine, and protein one need not be concerned about the intake of the other minerals. Why is this statement true?

10. Describe the functions of iron in the body.

11. Explain why listlessness and fatigue are common findings in patients who have anemia.

12. What is the daily requirement of iron for a nurse? for a pregnant woman? for a 13 year old boy?

13. What foods are most effective for blood regeneration?

14. Why is iodine an important mineral for body functions?

15. Give three ways in which the iodine intake can be made adequate.

16. What is the result of a deficiency of iodine in the diet?

17. What are the functions of copper, sulfur, sodium, potassium, magnesium, and chlorine in the body? How are these elements provided?

18. What is meant by each of the following:
    a. Availability of iron
    b. Trace element
    c. Acid-base balance
    d. Alkaline reserve
    e. Acid-forming food
    f. Achlorhydria
    g. Rickets
    h. Cretinism
    i. Goiter belt

19. What foods would you include daily to insure an adequate intake of the minerals? What minerals are found in significant quantities in each of the foods you have listed?

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CHAPTER VII

The Fat-Soluble Vitamins

INTRODUCTION TO STUDY OF THE VITAMINS

Discovery. The discovery of vitamins has had such far reaching effects that no field of medical research today offers greater opportunities than those which are possible in the realm of nutrition studies. Dr. Eijkman, a Dutch biologist, was the first to make experimental feeding studies to show definitely that beriberi, or a disease showing similar symptoms of nerve disturbance, could be produced or cured at will in hens by changing the diet of unpolished rice to milled rice, or the reverse. In 1906 he wrote: "There is present in rice polishings a substance of a different nature from proteins, fats, or salts which is essential to health and the lack of which causes nutritional polyneuritis."[1] At the same time Hopkins had found that laboratory animals could not live and thrive on purified mixtures of proteins, carbohydrates, fats, and inorganic salts. Fed such a diet, the animals ceased to grow, sickened, and eventually died unless the purified ration was changed. Although made in 1906, these findings were not published until 1912. In the meantime investigations along similar lines were being carried on in laboratories throughout the world. It was discovered that a substance or substances present in nutrients in their natural form were lacking in them when purified. These factors were designated as fat-soluble A and water-soluble B.

Nomenclature and Definition. In 1911 Funk published a paper showing the results of his studies in beriberi, and in this paper he coined the name "vitamine", calling the water-soluble B the "beriberi vitamine." While the final "e" in the spelling was dropped when scientists discovered that the chemical nature was not what Funk had originally supposed, "vitamins" is still the name given to a group of organic substances other than protein, carbohydrates, and fats which are absolutely essential for the maintenance of

growth and health in all ages. The vitamins are potent organic compounds which occur in minute quantities in foods and are essential for some specific body functions.

Early classifications listed two groups of vitamins, namely, those which are water soluble and those which are fat soluble. With respect to properties and functions, however, it was soon found that there was wide divergence between the various members of each group. The subject of vitamins will include in this chapter a discussion of the fat-soluble vitamins A, D, E, and K while the following chapter will include the water-soluble ascorbic acid, and the many members of the B complex — thiamine (B_1), riboflavin (B_2), niacin, pyridoxine (B_6), pantothenic acid, biotin, choline, and inositol.

The various deficiency diseases which result from lack of the vitamins are discussed in Chapter XX. The student might well correlate the material in the latter chapter with her study of the vitamins.

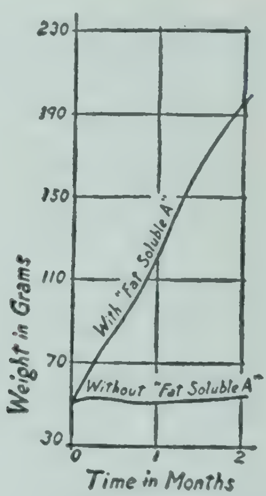
Unsolved Problems Concerning the Vitamins. Diligent studies by workers in laboratories all over the world have resulted in the determination of the chemical formulas of many of the vitamins, and synthesis of some of them. A deeper insight into their exact role in nutrition has been gained but the student must remember that many fundamental questions about vitamins have not even been touched upon. Methods for the determination of vitamin values in foods are constantly being improved, and with this advancement one can expect to obtain figures which are more and more reliable. The questions of the effects of food processing — freezing, canning, dehydration, storage, cooking — have been studied at some length, but much still remains to be learned. While a great deal is known about the amounts of the various vitamins which are needed for the prevention of deficiency diseases, it is not possible to make any positive statements about the optimum or ideal levels. The manner in which the vitamins perform their manifold functions in the body is still, in most cases, essentially an unsolved mystery. Very little is yet known about the more recently discovered factors and their probable relation to human health. Other vitamins may not even be discovered. And then there is the vast problem of the interrelationship of all of the nutrients. It is hoped, therefore,

that the student will not permit her fund of knowledge to remain static, but will have a receptive mind so that she will ever seek to increase her knowledge as new information becomes available.

VITAMIN A

Discovery. The earliest records of man indicate that night blindness has always been a common ailment. About 1850 B.C. the Egyptians recognized the curative value of liver, and again in the fifth century B.C. Hippocrates prescribed raw beef liver and honey for the correction of poor vision at night.

Scientific evidence of the factor responsible for the cure of night blindness did not come until the early part of the present century, however. In 1913 McCollum and Davis, and Osborne and Mendel simultaneously reported that certain animal fats as butter would promote growth in experimental animals while other fats as lard



Courtesy of Dr. E. V. McCollum

FIG. 10.
Figure showing the effect upon growth of adding "fat-soluble A" to a diet adequate in all other respects.

were ineffective. Cod liver oil was discovered to be a very potent source of the growth-promoting factor which was designated as vitamin A, the first fat-soluble vitamin to be discovered. It was soon established that vitamin A was in some way related to chlorophyll, the coloring matter of plants, and by 1932 carotene which occurs

abundantly in green leaves had been shown to be the precursor, or mother substance, of vitamin A.

Chemistry and Characteristics. Vitamin A in its pure form is a colorless, crystalline compound with a chemical formula of $C_{20}H_{29}OH$. It is soluble in fat but insoluble in water, and is stable to the usual cooking temperatures. However, it is easily oxidized.

Carotene, an oily orange-yellow pigment, is a precursor of vitamin A. Four carotenes are of nutritional significance, namely, alpha —, beta —, gamma carotene, and cryptoxanthine. Each molecule of beta carotene yields two molecules of vitamin A, while each molecule of the other three carotenes yields on hydrolysis only one molecule of vitamin A.

Measurement. Vitamin A is measured in International Units, one unit being equal to the activity of 0.6 microgram (0.0006 milligram) of beta carotene or 0.3 microgram of crystalline vitamin A.

Physiology. It has been postulated that fat is necessary for the absorption of vitamin A, but recent experimental work has been of a controversial nature. Bile is necessary for the absorption of carotene, but is apparently not required by vitamin A. Factors which interfere with fat absorption are probably apt to minimize absorption of vitamin A as well. Liquid petrolatum taken immediately before or after meals seriously interferes with the absorption of carotene, and therefore mineral oil should be used only with a doctor's prescription.

The body possesses a great capacity for storing vitamin A, about 95 per cent of that stored being held in the liver. Small amounts are also to be found in the kidney and lungs. The capacity for building reserves at any given time does not seem to be unlimited, for the most efficient storage occurs at moderate levels of intake. The reserves in the liver are relatively small at birth, but increase gradually with age. Not only is the liver the chief site of the body stores, but the conversion of the precursor carotene to usable vitamin A also occurs in hepatic tissue.

Functions. The maintenance of normal vision in dim light is one of several functions of vitamin A. The mode of action is that of combining vitamin A with a protein to form visual purple, an essential constituent of the retina of the eye. The visual purple in turn absorbs light and is decomposed to visual yellow. Vitamin A is

necessary for the rapid and continuous conversion of visual yellow to visual purple.

Another vital role of this vitamin is the maintenance of the integrity of the epithelium, especially that of the mucous membranes which line the eyes, the mouth and related glands, and the genitourinary and respiratory tracts.

All of the vitamins are more or less concerned in growth, but vitamin A seems to be especially important for skeletal growth. It is needed for a somewhat different purpose than vitamin D which is also essential for skeletal development. Normal reproduction and lactation cannot take place without vitamin A.

Effects of a Deficiency. It should be realized that a deficiency of vitamin A may be due either to inadequate intake or to factors of faulty metabolism such as chronic diarrhea as in sprue and colitis, liver disease, abnormal fat metabolism as in pancreatic dysfunction, or incomplete absorption because of the use of liquid petrolatum. Deficiency of vitamin A may not be manifested for several weeks or months, depending upon the reserve present in the liver.

Night blindness may be one of the early signs of vitamin A deficiency. One's difficulty in adjusting to dim light, or to the glare of automobile headlights may be the direct result of insufficient vitamin A for the regeneration of visual purple at the necessary rate of speed. Extreme deficiencies of vitamin A lead to xerophthalmia, an eye disease which is very rare in the United States. This disease is characterized by a softening of the cornea which leads to eventual blindness.

Skin changes have been noted particularly in the Orient by several nutrition workers. The skin becomes dry and scaly with pustules forming about the hair follicles of the extremities, shoulders, lower abdomen, and buttocks.

Definite changes take place in the epithelial tissues of the mucous membranes throughout the body; a noticeable shrinking, hardening, and progressive degeneration of the cells. The healthy cells are replaced to a certain extent by keratinized cells, obstruction of the secretory ducts occurs, and irritation may develop. Inflammations of the nasal passages, the sinuses, middle ear, and lungs frequently occur as a result of severe deficiency. A deficient supply of vitamin A is also believed to be a factor in the formation of urinary

calculi. The administration of greatly increased amounts of vitamin A during infection has little beneficial effect on the course of the disease, and there is no justification for the term "anti-infective."

An inadequate supply of vitamin A is responsible for a limitaton of skeletal growth which is different from that resulting through vitamin D lack. Tooth changes which occur as a result of insufficient vitamin A are concerned primarily with defective formation of enamel and dentine according to Mellanby.

EFFECTS OF VITAMIN A ON GROWTH AND HEALTH

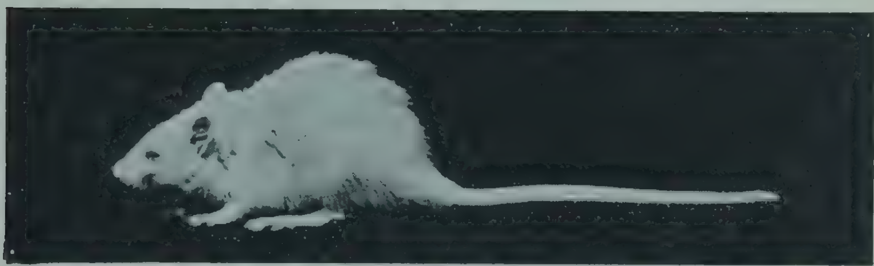
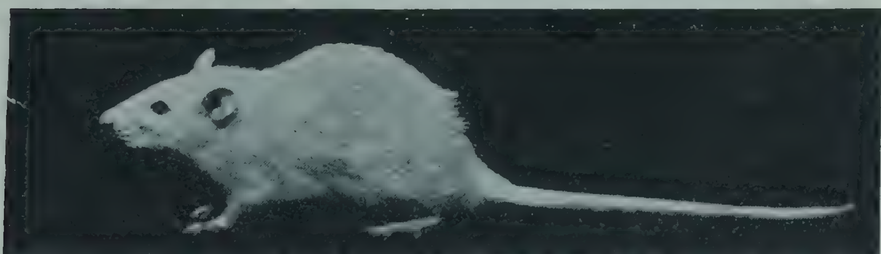


FIG. 11*a*. DIET ADEQUATE EXCEPT FOR VITAMIN A



Courtesy of Bureau of Home Economics, U. S. Dep't of Agriculture

FIG. 11*b*. VITAMIN A ADDED TO THE SAME DIET
Litter mates of the same sex, 11 weeks old. Weight of smaller, 56 grams ; of larger, 123 grams. Note infected eye, rough fur, and lack of vigor of the smaller rat.

Daily Allowances. Optimum nutrition requires much more vitamin A than is necessary for the prevention of deficiency disease. Increased intakes are necessary during growth, pregnancy, and lactation; certain diseases as tuberculosis demand additional allowances. The following daily allowances have been recommended by the Food and Nutrition Committee of the National Research Council.

RECOMMENDED DAILY ALLOWANCES FOR VITAMIN A[2]

	I.U.
Man	5000
Woman	5000
Pregnancy, latter half	6000
Lactation	8000
Children, under 1 year	1500
1–3 years	2000
4–6 years	2500
7–9 years	3500
10–12 years	4500
Girls, 13–20 years	5000
Boys, 13–15 years	5000
16–20 years	6000

Food Sources. Fish-liver oils are excellent sources of vitamin A as such. Milk, butter, whole-milk cheeses, liver, and eggs contain mixtures of vitamin A and carotene although the amount of vitamin A is generally much higher than that of carotene.

Carotenes are widespread in those plant foods which have high green or yellow colorings. There is a direct correlation between the greenness of a leaf and its carotene content. For example, the outer green leaf so often discarded from a head of lettuce may have 20 to 30 times as much carotene as the central bleached leaves. The abundant sources of carotene are in such foods as:

Green leafy vegetables—spinach, turnip tops, chard
Green stem vegetables—asparagus, broccoli, celery
Yellow vegetables—carrots, sweet potatoes
Yellow fruits—apricots, peaches

Planning the Daily Diet. Since most vegetables are rich sources of carotene, it is better to consider them as a class than to stress the use of any one individual member of the group. However, it must be remembered that the green leafy parts are the highest in carotene. In selecting the foods to furnish vitamin A in the diet it is well to keep the following points in mind: (1) under normal circumstances it is better to use common food sources than concentrates, because foods furnish other essential factors as well; (2) it is better to err on the side of an oversupply than an undersupply, because the surplus will be stored in the body for maintaining resistance to infection; (3) it is important to determine how often any

given food will be used in the dietary; and (4) the amount of food which can be used must be ascertained. For example, 100 grams of parsley furnishes 18,000 I.U., whereas 100 grams of milk supplies only 170 I.U. of vitamin A. Parsley, as a garnish, will have a limited use, while one pint or one quart of milk a day, which is considered essential in an adequate diet, furnishes a considerable part of the day's needs for vitamin A.

The content of vitamin A in animal foods has been found to vary with the diet of the animal.

The daily diet should include the following foods to insure adequate intake:

	CHILDREN	ADULTS
Milk	1 quart	1 pint
Egg	1	1
Butter, or fortified margarine	1 ounce	1 ounce
Green or yellow vegetables	2 servings	2 servings

Whenever deficiency of vitamin A is the result of liver injury and the consequent failure to convert carotene to vitamin A, it is important to supply foods which contain the preformed vitamin — liver, milk, eggs, etc.

Retention of Food Values. The boiling of foods under ordinary conditions results in only slight losses if there is proper protection from oxidation. A long, slow cooking is more destructive of vitamin A than short, rapid cooking. Stirring of foods increases the rate of oxidation. The wilting of vegetables or dehydration of foods results in a very great loss of vitamin A. It is important, therefore, to select fresh, crisp vegetables while marketing, and to avoid subsequent wilting. Canned and frozen foods retain maximal values for nine months or longer. However, if frozen foods are thawed and allowed to stand for any length of time, losses may be appreciable.

VITAMIN D

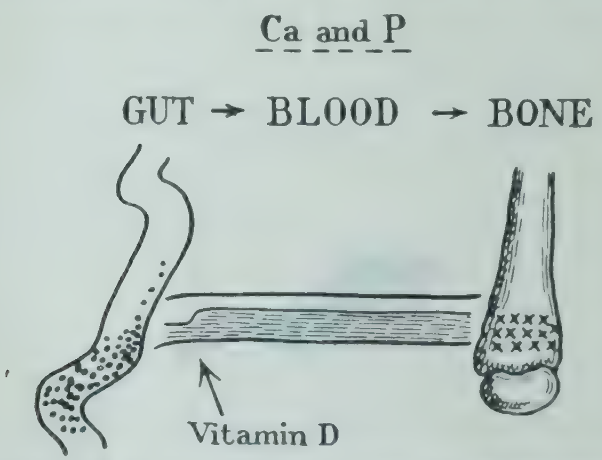
Discovery. Many painful attempts have been made in the past to straighten the bones of rachitic children. In 1917 Doctors Hess and Unger noted the protective effect of cod liver oil against rickets. Then in 1919 Mellanby found that the skeletal structure of puppies was influenced by the fat-soluble substance in food. McCollum,

Steenbock, and Drummond simultaneously reported that cod liver oil in which vitamin A had been destroyed still retained its anti-rachitic properties. Steenbock and Hess independently showed the anti-rachitic effect of foods which had been exposed to ultraviolet rays.

Chemistry and Characteristics. Vitamin D was isolated in crystalline form in 1930 and was called calciferol, C_{28} $H_{43}OH$. About 10 forms of this vitamin are known, but only two are of interest here: (1) activated ergosterol, or viosterol — ergosterol being the chief vitamin D precursor found in plants; and (2) activated 7-dehydro-cholesterol which is the outstanding form in fish-liver oils, irradiated milk, and irradiated animal products generally and is believed to be the vitamin substance developed in the skin on exposure to ultraviolet light. Vitamin D is stable to a marked degree; the influences of storage, heating, autoclaving, and oxidation are not adverse.

Measurement. One International Unit of vitamin D is the activity of 0.025 micrograms of pure crystalline vitamin D. It is the amount which must be given daily to rachitic rats for eight days to produce a good calcium line in the uncalcified area of the long bones.

Physiology. Active vitamin D is absorbed by the blood from the skin or the intestines, and is stored primarily in the liver although



Courtesy of Dr. L. J. Harris, "Vitamins," The Cambridge University Press

Fig. 12. How Vitamin D Works

With more vitamin D there is increased "net-absorption" of Ca and/or P from the intestine, their level in the blood rises, and so more is precipitated in the bone.

some is also found in the skin, brain, lungs, spleen, and bones. The body retains its stores of vitamin D carefully. Bile salts appear to be necessary for the absorption of this vitamin.

Function. While the exact manner in which the anti-rachitic vitamin works is not known, it has been established that it regulates the absorption and anchorage of calcium and phosphorus. In other words, calcification of bone and tooth structures is dependent in large measure on the normal concentration of calcium and phosphorus in the blood. Because of its ability to retain calcium in the body, vitamin D also probably plays an indirect part in the facilitation of blood clotting, normal heart action, and normal nervous stability.

Effects of a Deficiency or Excess. A lack of vitamin D because of low intake or faulty absorption and metabolism leads to rickets in children. The clinical changes include enlargement of the wrists, knees, and ankles, bowing of the legs, beading of the ribs and appearance of rachitic rosary, protruding forehead, and stunted growth. In adults, a deficiency of vitamin D leads to softening of the bones, especially in women.

Extremely large doses of vitamin D have been known to be toxic as manifested by calcification occurring in soft tissues such as the heart, blood vessels, bronchi, stomach, and tubules of the kidney. Rapid loss of weight, diarrhea, muscular weakness, and hypercalcemia have occurred in individuals so affected. The margin between the therapeutic dose of vitamin D and the toxic dose is extraordinarily wide. It is believed that an excess of 150,000 I.U. daily is necessary before toxic symptoms appear.

Daily Allowances. The daily diet furnishes such a very small amount of vitamin D that it must be assumed either that the need for it in adults is low, or that the requirements are met by exposure to sunlight. Whenever new skeletal tissue is being built there is a definite increase in the needs for vitamin D. The Food and Nutrition Committee of the National Research Council recommends 400-800 I.U. for children, and for pregnant or lactating women.

Sources. Foods, as consumed in the daily diet, are poor sources of vitamin D although small amounts are present in eggs, liver, and fish such as herring, sardines, tuna, and salmon. Milk may be fortified in the vitamin D content by (1) irradiating the cow, (2) irra-

FIG. 13*a*. THESE FOUR DOGS FROM THE SAME LITTER WERE GIVEN A DIET LACKING VITAMIN D

Note the same size and limb deformity produced by these deficits. Children deprived of dairy products run the risk of these same bone imperfections.

Courtesy of Dr. Agnes F. Morgan, University of California

FIG. 13*b*. THIS VIEW SHOWS THE IMPROVEMENT MADE BY THE ADDITION OF A SMALL AMOUNT OF COD LIVER OIL.

diating the milk, (3) adding concentrates of viosterol to the milk; the last two methods are used extensively in the commercial fields. Milk which has been irradiated contains 135-400 I.U. per quart, and is a suitable source of the vitamin for growing children. Fish liver oils provide the most potent source of the vitamin and should be included daily for growing children, pregnant women, or lactating women. Cod liver oil meeting U.S.P. standards must contain not less than 85 I.U. of vitamin D per gram or 312 I.U. per teaspoon. Infants should receive one half teaspoon of cod liver oil twice daily at the age of two to three weeks, gradually increasing the amounts until at the age of three months the child is receiving one and one half teaspoons twice daily.

Sunlight cannot always be depended upon to supply the body with adequate ultraviolet rays to manufacture vitamin D, because these rays are so easily strained out by dust, smoke, and ordinary window glass — all of which act as barriers, preventing the rays from reaching the skin.

VITAMIN E

Evans and Bishop established the fact that a fat-soluble factor was necessary for reproduction in rats. They showed that absence of vitamin E, as it was designated, led to irreparable damage of the germinal epithelium in male rats, while female rats who had diets deficient in vitamin E were unable to carry their young to term. In the female the damage was not permanent, that is, normal reproduction could again take place if the diet was once more made adequate in this factor. A lack of vitamin E in the diet of rabbits and guinea pigs has also been shown to lead to muscular dystrophy and paralysis of the hind quarters. It is presumed that vitamin E is essential to human beings; however, its abundant occurrence in foods makes it difficult to provide diets for man in which the intake of vitamin E is low enough to give direct evidence of need.

The formula for vitamin E, also known as alpha tocopherol, is $C_{29}H_{50}O_2$. Vitamin E activity has been exhibited by more than 130 compounds of related chemical structure. High temperatures and ordinary light do not affect the stability of vitamin E, but oxidation takes place readily in the presence of iron salts or rancid fats. Oils of the wheat germ, cottonseed, rice germ, and the germ of other seeds are potent sources of vitamin E, although smaller concentrations are present in leafy green vegetables, eggs, and meat.

The possible daily requirements of vitamin E cannot be stated positively at this time, nor is there sufficient clinical evidence to show the value of this factor in the treatment of menstrual disorders, the prevention of abortion, or the improvement of lactation.

VITAMIN K

Discovery. One of the recently discovered vitamins which has been used with great success clinically is vitamin K. Its existence was first suggested by Dr. Dam of Copenhagen who in 1935 found

that a "Koagulations Vitamin" was necessary for normal blood clotting. Schönheyder noted that lack of this factor led to a lower prothrombin content in the blood. Holst and Halbrook found fresh cabbage, alfalfa, or fish meal prevented the deficiency disease in chicks, while Almquist and Stokstad established the fact that bacterial action on certain materials produced vitamin K in the intestine.

Chemistry and Characteristics. Vitamin K_1 was isolated from alfalfa and vitamin K_2 from putrefied fish meal about 1938. Vitamin K_1, $C_{31}H_{46}O_2$, is fat soluble. Its activity is easily destroyed by acids, alkalies, and light. A number of compounds possess vitamin K activity. One of these is menadione, a water-soluble compound, which has been found to be three times as potent as the vitamin itself.

Functions and Physiology. Vitamin K is necessary for the formation of prothrombin. The actual mechanism by which it works is not known although it has been shown that impaired hepatic function leads to failure to utilize vitamin K in the formation of prothrombin. Bile salts are necessary for absorption from the intestine, and liquid petrolatum does interfere with its absorption. The body stores only a limited amount of the vitamin.

Effect of a Deficiency. It is rarely that a deficiency of vitamin K occurs because of faulty diet. The more common causes are (1) absence of bacteria in the gastro-intestinal tract for vitamin K synthesis, (2) faulty absorption when the secretion of bile is diminished, following obstruction of the bile duct, subsequent to intestinal lesions, or diarrhea, or (3) liver injury as in hepatitis or cirrhosis. The prothrombin level should be watched whenever an abnormality of the intestinal mucosa is present.

Prothrombin deficiency exists in the newborn infant during the first few days of life. It has been found that administration of vitamin K to the mother $\frac{1}{2}$ to 48 hours before delivery is effective in preventing hypoprothrombinemia.

Daily Allowances. The exact needs of vitamin K are not known, but it appears that one to two milligrams will satisfy the daily need. Dietary deficiency is usually not a problem in man.

Sources. Green leaves of plants such as alfalfa, spinach, cabbage, kale, and cauliflower are excellent sources of vitamin K while fruits

and other vegetables are poor sources. Hog liver is also a good source of the vitamin. Bacterial action in the intestine is responsible for the manufacture of vitamin K in the body.

PROJECTS

1. Calculate the amounts of each of the following foods necessary to supply 1000 I.U. of vitamin A: butter, milk, whole egg, carrots, broccoli, liver, spinach, tomatoes, onions, beets.

2. Calculate your own daily intake of vitamin A. List animal sources and plant sources separately.

SUMMARY OF THE FAT-SOLUBLE VITAMINS

CHARACTERISTICS	FUNCTIONS	EFFECT OF DEFICIENCY	SOURCES
VITAMIN A or CAROTENE (provitamin A) Stable to heat Destroyed by oxidation and drying *Physiology* Bile necessary for absorption Mineral oil interferes with absorption Stored in liver Increased need in growth, pregnancy, lactation, infections Injured liver unable to convert carotene to vitamin A	Regeneration of visual purple Maintain normal epithelium of mucous membranes Normal growth Normal reproduction and lactation	Decreased resistance to infections of nose, sinuses, lungs, ears, eyes, genito-urinary tract Stunted growth Defective dentine formation Night blindness Xerophthalmia, if deficiency is severe	Fish liver oils Milk Butter Whole milk cheese Egg yolk Liver Green vegetables Yellow vegetables Tomatoes Yellow fruits
VITAMIN D or CALCIFEROL Two forms are important: Activated ergosterol Activated 7-dehydro cholesterol Very stable *Physiology* Absorbed from skin or intestines Stored in liver	Regulate absorption and anchorage of calcium and phosphorus Normal skeletal development	Poor posture Bowed legs Stunted growth Soft bones Carious teeth Rickets in children Osteomalacia in adults	Fish liver oils Irradiated foods Activated sterols Viosterol Exposure to sunlight

SUMMARY OF FAT-SOLUBLE VITAMINS (*Continued*)

CHARACTERISTICS	FUNCTIONS	EFFECT OF DEFICIENCY	SOURCES
VITAMIN E OR ALPHA TOCOPHEROL Stable to heat and light Oxidized by iron and rancid fats	Normal reproduction	In animals: Sterility in male Resorption of fetus in females	Oils of wheat germ, cottonseed, rice Green leafy vegetables
VITAMIN K OR MENADIONE Easily destroyed by heat, light, acids, alkalies *Physiology* Bile necessary for absorption Synthesis in intestine	Formation of prothrombin	Prolonged clotting time of blood Hemorrhage in newborn infants	Green leaves as alfalfa, spinach, cabbage Liver Synthesis by bacteria in intestine is important source

REVIEW QUESTIONS

1. What was the significance of the work of Dr. Eijkman? of Dr. Hopkins?

2. Define the word vitamin.

3. List six problems relative to knowledge about vitamins which still confront the nutrition worker.

4. What is the relation of carotene to vitamin A? What factors may modify the utilization of carotene by the body?

5. Discuss three functions of vitamin A.

6. What is meant by an International Unit of vitamin A?

7. Describe the changes which take place in epithelial structures as a result of vitamin A deficiency. What diseases would likely be more prevalent in the presence of such deficiency?

8. List four points to keep in mind when planning the daily diet for its adequacy in vitamin A.

9. What precautions would you take to insure maximum retention of vitamin A value in foods?

10. What are the two common forms of vitamin D? Where do they occur?

11. Why is vitamin D essential for calcium and phosphorus metabolism?

12. What is meant by an International Unit of vitamin D?
13. What is the daily allowance of vitamin D for a growing child?
14. In what ways is an adequate intake of vitamin D assured?
15. Describe the effects of a deficiency of vitamin D.
16. What is the probable significance of vitamin E in nutrition?
17. What is the chief function of vitamin K?
18. Dietary deficiency of vitamin K is usually not a problem. Why?
19. To what factors may a deficiency of vitamin K be attributed?

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CHAPTER VIII

The Water-Soluble Vitamins

ASCORBIC ACID OR VITAMIN C

Discovery. One of the most serious problems of the adventurer and explorer several hundred years ago was the frequent occurrence of scurvy. This disease plagued the Crusaders, and was the most prevalent disease in Europe during Columbus' day. Cartier in 1535 reported that scurvy was responsible for the death of one fourth of his men during a winter in Canada. Even at that time, however, the native Indian had realized the curative effects of certain herbs.

Somewhat later the New England pioneers were confronted with scurvy. They discovered the value of the potato, fruits, and germinating seeds. Dr. Lind, a British naval surgeon, about 1757, found that limes possessed antiscorbutic properties and from that time on these citrus fruits were included in the fare of the sailor. An American physician, Budd by name, advanced the theory that the antiscorbutic property possessed by certain foods was a definite chemical compound which he predicted would be identified as such in a not too distant future. Almost one hundred years elapsed before the independent studies of Dr. C. G. King and his coworkers of the the University of Pittsburgh, and Dr. A. Szent-Györgyi of Hungary resulted in the isolation and chemical identification of this substance. The isolation and synthesis of ascorbic acid, or vitamin C, was subsequently accomplished in many laboratories.

Chemistry and Characteristics. Pure vitamin C is a white, crystalline compound which dissolves readily in water. It is closely related to the monosaccharide sugars, its formula being $C_6H_8O_6$. Of all the vitamins, ascorbic acid is the most labile. It is quickly oxidized by heat, light, alkalies, enzymes, and such metals as copper and ferrous iron. The processes of oxidation are inhibited to a marked degree in the presence of acids, and to some extent when the concentration of carbohydrate is high.

Measurement. Since the isolation of vitamin C it has been possible to express concentrations in units of weight. The milligram and the microgram are both used for indicating values; one milligram is equal to 1000 micrograms. The International Unit which was used in early work is equal to 0.05 mg. of vitamin C.

Functions. The most important function of ascorbic acid is the control which it exercises on the ability of cells to produce intercellular material. In other words, vitamin C is like a binding which holds the cells in proper relation to each other and to the fluid which bathes and nourishes them. The healthy development and maintenance of the capillary blood vessels, the teeth, the bones, the connective tissues, the bone marrow, and the tissues which surround the joints are all dependent on this function.

Another role of vitamin C is that of increasing resistance to infections. King and Menten found that resistance of guinea pigs to diphtheria toxin was decidedly increased when supplies of vitamin C were adequate. The additional need for ascorbic acid during tuberculosis, rheumatic fever, and colds also suggests a role in combatting infection.

Storage. The body has a relatively limited capacity for storing ascorbic acid. Whenever the intake of vitamin C has been deficient for some time, it has been found that the tissues will utilize all of that given in the diet with scarcely any excretion occurring. On the other hand, urinary excretion of vitamin C is very high whenever the tissues are saturated with ascorbic acid. The urinary output varies with the intake when the tissues are in a good state of nutrition.

There is some relation between the concentration of vitamin C and the activity of the tissue. For example, glandular tissues retain the greatest amounts, lean muscle tissue is relatively low, and fats contain negligible amounts. The normal concentration of vitamin C in the blood is about 1.2 mg. per 100 cc.

Effect of a Deficiency. If the diet is lacking or almost lacking in ascorbic acid for two to four months, symptoms of scurvy will appear. The many signs of impairment of body functions are merely results of failure to produce intercellular substance in a normal fashion. The pathological changes include:

1. Structural changes in the gums and the teeth. The teeth are

said to be among the first organs to show the effects of shortage of vitamin C.

2. Small cutaneous hemorrhages which occur over the body as a result of the weakening of the walls of the capillary blood vessels.

3. Changes in the growing ends of the bones with deformities which are frequently confused with rickets. Calcification of the bones is defective due to degeneration or to a lack of proper development of the bone matrix. Vague pains may be present in the joints or limbs, especially during growth.

4. Weakness of the cartilage and displacement of the bones supported by it.

5. Anemia due to interference with the blood-forming cells in the bone marrow as well as loss of blood from hemorrhage.

6. Damage to the heart muscle sometimes accompanied by enlargement of the heart.

7. Degeneration of muscle structure generally.

8. Retardation and stunting of growth.

EFFECT OF VITAMIN C ON GROWTH AND HEALTH

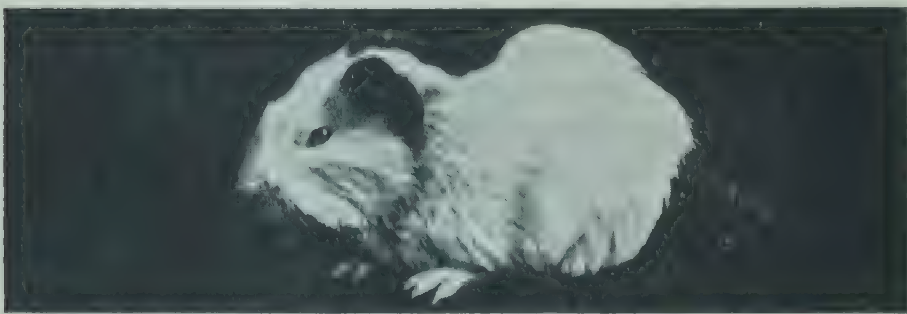
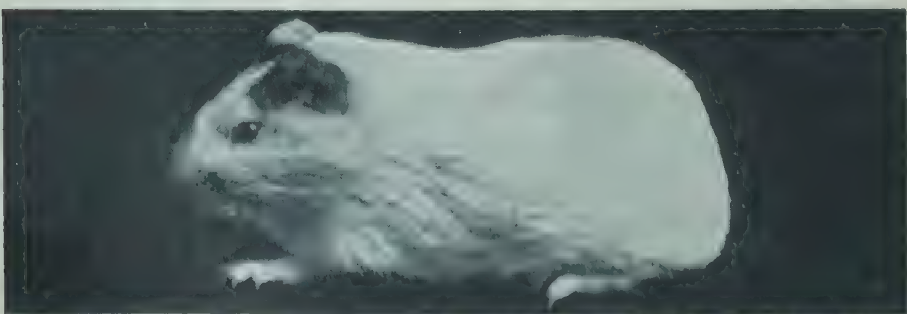


FIG. 14*a*. DIET ADEQUATE EXCEPT FOR VITAMIN C



Courtesy of Bureau of Home Economics, U. S. Dep't of Agriculture

FIG. 14*b*. VITAMIN C ADDED TO THE SAME DIET

Guinea pigs of the same age and sex, 22 days on the diets. The rough fur and the crouched position, due to sore joints, indicate scurvy in the smaller guinea pig. Rats do not develop scurvy.

These changes represent, to be sure, those which occur in manifest scurvy but it must be remembered that many of them can and do occur long before clinical scurvy is apparent. Early signs of vitamin C deficiency include such vague symptoms as increased susceptibility to infection, irritability, retardation of growth, and poor health in general.

Daily Allowances. Investigations have shown that an intake of 25 mg. of ascorbic acid daily is sufficient to protect an adult from scurvy. However, this represents only a very small part of the amount needed to assure optimum health. The factors of growth, pregnancy, or lactation increase the daily need for vitamin C. During any infection it must be borne in mind that the need is also probably augmented considerably. The standards suggested by the Food and Nutrition Committee of the National Research Council are:

RECOMMENDED DAILY ALLOWANCES FOR VITAMIN C[1]

	Milligrams
Man (70 Kg.)	75
Woman (56 Kg.)	70
Pregnancy	100
Lactation	150
Children, under 1 year	30
1–3 years	35
4–6 years	50
7–9 years	60
10–12 years	75
Girls, 13–20 years	80
Boys, 13–15 years	90
16–20 years	100

Food Sources. Vitamin C has been called the vitamin of fresh foods, since it is found in highest concentration just as the food is fresh from the plant or animal. Raw or canned citrus fruits such as oranges, lemons, and grapefruit are generally recognized to be excellent sources of this vitamin, but it should be remembered that tomatoes in any form, fresh berries, and raw, green, leafy vegetables such as cabbage and spinach are also very good sources. In general, the active parts of the plant contain appreciable amounts while mature or resting seeds are devoid of the vitamin. Potatoes,

carrots, and bananas contain small proportions of ascorbic acid but they are a valuable aid in meeting the daily needs of the body.

Planning the Daily Diet. The simplest way to insure adequate intake of ascorbic acid is to include one serving of orange or grapefruit daily, or a double portion of tomato. Whenever these foods are inaccessible because of economic factors, it is necessary to rely on other less potent sources, such as cabbage, turnips, potatoes, apples, and green leafy vegetables all of which contribute significantly to the daily intake when they are properly prepared.

Retention of Food Values. The preservation of ascorbic acid in cooked foods is especially important when citrus fruits are unavailable in the daily diet. The various factors which cause definite and sometimes complete loss of vitamin C make it necessary to keep the following points in mind when selecting foods to fill the daily requirements. The maximum amount is found in raw, fresh foods, and the detrimental influences of a warm environment, exposure to air and consequent wilting, solubility in water, cooking, alkali, and dehydration should be remembered so that proper precautions can be taken for maximum retention of food values. Details for preserving the vitamin C in foods will be discussed in the chapters on fruits and vegetables (XLV and XLIV).

CITRIN

The fact that in certain cases pure ascorbic acid did not always bring about the same results as the natural vitamin (as in orange juice, for example) led investigators to look for a factor other than ascorbic acid. Such a substance has been isolated and given the name of citrin, or vitamin P, meaning permeability vitamin. Clinical trial of this substance has been reported to bring about improvement of capillary resistance in vascular purpura. There is no definite evidence of the value of this vitamin as a dietary factor.

THE VITAMIN B COMPLEX

The story of the vitamin B complex is that of an ever growing family. Beriberi is a serious deficiency disease which has been known for many centuries, especially in the Orient. The earliest correlation between it and a deficient diet was made by Takaki, a

physician in the Japanese navy, who, in 1878-1883, had observed that the addition of meat, fish, and vegetables to the usual rations of rice was instrumental in preventing the occurrence of the disease. He believed that protein was the factor responsible for the lessened incidence of beriberi. Dr. Eijkman, a Dutch biologist, in 1897 was the first to produce polyneuritis experimentally in hens by means of deficient diets. Then Dr. Funk in 1911 proposed the name "antiberiberi vitamine" for the water-soluble factor which he had found to be essential in the production of this deficiency disease.

It was soon discovered that vitamin B was not a single substance but a group of compounds which we now designate as the vitamin B complex. It was found that a growth-promoting factor more stable to heat remained after the antineuritic factor was more or less destroyed; to this substance which proved to be a water-soluble yellow pigment was given the name "vitamin G." Still further research proved vitamin G to be a mixture of riboflavin and niacin. There are at least 12 factors in the complex, nine of which have been obtained in their pure form. They are:

Thiamine, or vitamin B_1 — also called aneurin in Europe.
Riboflavin, or vitamin B_2
Niacin, or nicotinic acid
Pyridoxine, or vitamin B_6
Pantothenic acid
Choline
Biotin, formerly called vitamin H
Inositol
Para-aminobenzoic acid

These vitamins will each be discussed in turn.

THIAMINE OR VITAMIN B_1

Discovery. The isolation of pure thiamine was accomplished by Jansen and Donath in 1926, and the synthesis and establishment of the chemical formula took place in the laboratory of Dr. Williams in 1936.

Chemistry and Characteristics. Thiamine hydrochloride, with a chemical formula of $C_{12}H_{17}N_4OSCl$, is a white substance readily soluble in water. The vitamin is very stable in its dry form, and is

not easily oxidized except in the presence of sulfite which quickly destroys it. Heating of vitamin B_1 at 120° C. in an acid medium has little effect, but cooking foods in a neutral or alkaline medium is very destructive.

Measurement. Vitamin B_1 is now measured in weight units; namely, as milligrams or micrograms. The earlier use of the International Unit as a standard of measurement makes it necessary to remember that one I.U. is equal to three micrograms of thiamine.

Functions. Thiamine is absolutely essential for one of the most fundamental of all body activities; namely, cell respiration. One of the stages of carbohydrate metabolism is the transformation of an intermediary product known as pyruvic acid. This change can take place only when the thiamine is present to act as an enzyme. Research workers are convinced that the many other functions ascribed to vitamin B_1 are in reality dependent on this one role in carbohydrate metabolism. For example, it is well known that lack of appetite results when the intake of thiamine is insufficient. This can be readily ascribed to the piling up of substances as pyruvic acid in the body when the amount of the vitamin B_1 necessary for its disposal is insufficient, and will be corrected when sufficient thiamine is supplied for normal carbohydrate metabolism. It is known too that this all important vitamin is needed for the maintenance of normal gastro-intestinal tone and motility, and for normal heart action. It has often been called the "morale" vitamin since it is closely associated with nervous stability.

Effects of a Deficiency. The symptoms and effects of thiamine deficiency are numerous and far reaching. The disease caused by severe lack of this vitamin is beriberi which is characterized by polyneuritis frequently accompanied by cardiac symptoms and generalized edema. Early investigators believed that beriberi was a disease of the Orient, but it is now evident that even in this country it often occurs as a result of chronic alcoholism coupled with dietary imbalance. A more detailed discussion of this disease will be found in the chapter on deficiency diseases (pages 277-8).

It is important for the student to realize that many signs of poor health may be indications of vitamin B_1 deficiency long before beriberi becomes evident. Dr. Williams and his coworkers[2] observed the effect of mild to moderate deficiencies on a group of normal women

FIG. 15*a*. DEFICIENCY OF ANTINEURITIC VITAMIN B, ADVANCED CASE
Photographs taken on 83d day of subsistence on deficient diet. Notice that contracture of hind-limb muscles occurs whether the animal is standing or lying down.

Courtesy of Dr. George B. Cowgill, New Haven, Conn.
FIG. 15*b*. DEFICIENCY OF ANTINEURITIC VITAMIN B, ADVANCED CASE
Before treatment and *4 hours after* receiving vitamin-B extract intravenously; dog is now able to walk but with slight spasticity of the hind limbs.

to include: loss of appetite, loss of interest in work, discouragement, depression, irritability, many neurasthenic complaints, fatigue, insomnia, and frequent headaches. There were frequent complaints of nausea, epigastric distress, and vomiting, while constipation was the rule. Blood pressure and pulse rates were low at rest, although moderate exertion resulted in tachycardia. Improvement in these deficiency states occurred within a few hours after giving vitamin B_1. The fatigue quickly disappeared, the subjects became more interested in their activities, and the food was eaten well.

Daily Allowances. The vitamin B_1 requirements are closely related to the carbohydrate metabolism. Williams and Spies state: "The absolute amount of thiamine required by an individual under ordinary circumstances rises in proportion to the food (or carbo-

hydrate) metabolized. When, however, the metabolic machinery is strained, as in the case of forcible feeding, above the demands of the appetite, the quantity of vitamin required per calorie of food shows a distinct tendency to rise. A similar rise in quantity of vitamin required per calorie of food is induced by exercise, by hyperthyroidism, or by the physiological strain of gestation and lactation."[3] The Food and Nutrition Committee of the National Research Council has adopted the following standards for daily allowances of thiamine.

RECOMMENDED DAILY ALLOWANCES FOR THIAMINE[1]

	Mg.
Man (70 Kg.)	
Moderately active	1.5
Very active	2.0
Sedentary	1.2
Woman (56 Kg.)	
Moderately active	1.2
Very active	1.5
Sedentary	1.1
Pregnancy, latter half	1.8
Lactation	2.0
Children up to 12 years	
Under 1 year	0.4
1–3 years	0.6
4–6 years	0.8
7–9 years	1.0
10–12 years	1.2
Children over 12 years	
Girls, 13–15 years	1.3
16–20 years	1.2
Boys, 13–15 years	1.5
16–20 years	1.8

Sources. Thiamine occurs in a great variety of foods although the concentration in most of them is relatively low. Dry brewer's yeast and wheat germ are the best sources while peas, beans, oatmeal, whole wheat, lean pork, and peanuts are excellent sources. In grains the embryo or germ and the outer covering contain the greatest amount of vitamin B_1. When the outer covering, or bran, is removed from the grain in refining processes, much of the vitamin contained in the food is also removed.

Milk is a good source of vitamin B_1, first because it is taken in relatively large amounts and second, because as a rule it is not subjected to other treatment than pasteurization, which does not materially reduce the vitamin B_1.

Eggs likewise furnish thiamine, the vitamin being concentrated in the yolk.

Fruits and vegetables generally contain low concentrations but they are considered to be valuable sources because they are eaten in appreciable quantities daily.

Planning the Daily Diet. In selecting the foods to furnish the essential daily amount of vitamin B_1, Sherman states: "If at least half of the needed calories are taken in the form of such 'protective' foods as milk, fruits, vegetables, and eggs, and at least half of the breadstuffs and cereals consumed are taken in the form of 'whole grain,' 'dark,' 'unskinned' products, excellent provision will have been made for thiamine and for other important vitamins and mineral elements at the same time."[4] The following foods should be included in the daily diet to insure adequate intake of thiamine.

1 pint milk
1 egg
2–3 servings whole-grain cereal and bread
2–3 servings fruit
1–2 servings raw vegetable
1–2 servings cooked vegetable

Retention of Food Values. Losses of vitamin B_1 in foods may occur as a result of (1) the solubility of thiamine in water, (2) the ready destruction in the presence of alkali, and (3) the prolonged exposure to heat. Cooked cereals keep most of their thiamine since the water is retained, and cookery takes place at moderate temperature. The greatest loss in vegetables is due to the solution of thiamine in water which is so often discarded, while the destruction from heating itself is much less. Baking of foods results in moderate loss of vitamin B_1. It is interesting to note that greater loss of thiamine may occur in the toasting of bread than in its baking. Dried fruits which have been exposed to sulfur gases have scarcely any thiamine. Canning apparently causes no loss of

the vitamin, except for that which has occurred in the blanching process. Storage of canned goods may result in a gradual loss of vitamin B_1.

RIBOFLAVIN OR VITAMIN B_2

Discovery. Goldberger and Lillie in pursuing their studies on pellagra produced a deficiency disease in rats which was characterized by ophthalmia and dermatitis. The material necessary for its cure was named the P-P (pellagra-preventive) factor by these workers, while other American biochemists adopted the name vitamin G. To increase the confusion, British workers assigned the name vitamin B_2 to the material since it was related to the B vitamins.

As early as 1879 a pigment which possessed a greenish fluorescence had been discovered in milk. Several workers renewed their interest in this substance, and obtained it from such widely varying sources as liver, yeast, heart, and egg white. The pigments which possess these fluorescent properties were designated as flavins.

In 1932 a yellow enzyme necessary for cell respiration was isolated from yeast by Warburg and Christian who also discovered that a protein and the pigment component were the two factors in the enzyme. It then remained for Kuhn and his coworkers to notice the relation of vitamin B_2 activity to the green fluorescence, thus establishing the fact that lactoflavin and the vitamin were one and the same thing.

It was thus shown that Goldberger had been working with a hitherto unknown vitamin rather than with the anti-pellagra factor as early believed. Riboflavin is the accepted name for this vitamin although the terms vitamin B_2 and vitamin G are still frequently seen in the literature.

Chemistry and Characteristics. Riboflavin was so named because of the similarity of part of its structure to that of the sugar ribose, and its relation to the general group of flavins. Its chemical formula has been found to be $C_{17}H_{20}N_4O_6$. In its pure state, this vitamin is an orange-yellow compound in which the crystals are needleshaped. It dissolves in water to give a characteristic greenish-yellow fluorescence. The material is stable to heat in acid solutions,

but is sensitive to the effects of alkali. It is quickly decomposed by ultraviolet light.

Measurement. Now that the vitamin has been isolated in its pure form it is possible to express values by weight in micrograms or milligrams. The earlier Sherman-Bourquin unit is equal to 3 to 5 micrograms of vitamin B_2.

Physiology. The body guards carefully its store of riboflavin so that even in severe deficiency as much as one third of the normal amount has been found to be present in the liver, kidney, and heart of experimental animals. A normally nourished man excretes 0.8 to 1.2 mg. of the vitamin in the urine daily, but the excretion increases markedly if a great elevation in the intake occurs. Apparently the flavin content of the body tissues cannot be increased beyond a certain point. On the other hand decided reduction in the supply leads to restriction or even curtailment of the urinary excretion.

Functions. The tenacity with which the body clings to its supply of riboflavin suggests a very fundamental role; and such is the case. We now know that vitamin B_2 is an essential constituent of the yellow oxidation enzyme, and that it cannot be synthesized in the body. This enzyme is found in all living cells. It possesses the ability of transferring oxygen. An important effect of optimum intake of riboflavin is that of enhancing nutritional well being and vigor; in experimental animals, at least, it has been shown that length of life was increased and that such increase corresponded to additional "prime of life." It has also been demonstrated that normal skin tone, digestion, and vision are dependent on adequate supplies of riboflavin, and that multiple symptoms are present when deficiency ensues. One of the newer findings is the beneficial effect of riboflavin on the utilization of food for the building of body tissues.

Effects of a Deficiency. The symptoms which have been described by Sydenstricker as occurring in the eye following deficient intakes of riboflavin include burning and itching of the eyes, blurred vision, sensitivity to light, soreness and swelling of the lids, and increase in the capillaries of the cornea. Typical skin changes described by Sebrell also occur such as the cheilosis or inflammation of the lips and fissures at the corners of the mouth, together

with scaliness of the epithelium around the nose and the ears.

Experimental animals (rats, mice, dogs, monkeys, chickens) show cataract, myelin degeneration of the nerves, and early senility with shortened life expectancy when riboflavin intake has been inadequate. Dogs on a markedly deficient intake collapse and die in six to eight weeks probably because of cell asphyxiation.

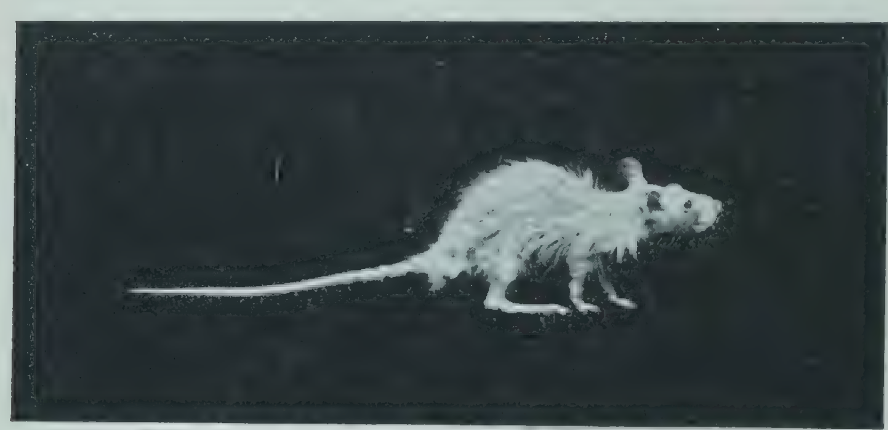


FIG. 16*a*. A DIET TOTALLY LACKING IN VITAMIN G.

Courtesy of Bureau of Home Economics, U. S. Dep't of Agriculture

FIG. 16*b*. THREE WEEKS AFTER VITAMIN G WAS ADDED TO THE DIET (Same Rat)

Daily Allowances. The optimum daily need for riboflavin is not known. The recommendations by the Food and Nutrition Committee of the National Research Council represent a factor of safety beyond that needed to prevent deficiency. The allowances for riboflavin are approximately one and one-third to one and one-half times those for thiamine.

RECOMMENDED DAILY ALLOWANCES FOR RIBOFLAVIN[1]

	Mg.
Man (70 Kg.)	
Moderately active	2.0
Very active	2.6
Sedentary	1.6
Woman (56 Kg.)	
Moderately active	1.6
Very active	2.0
Sedentary	1.5
Pregnancy	2.5
Lactation	3.0
Children up to 12 years	
Under 1 year	0.6
1–3 years	0.9
4–6 years	1.2
7–9 years	1.5
10–12 years	1.8
Children over 12 years	
Girls, 13–15 years	2.0
16–20 years	1.8
Boys, 13–15 years	2.0
16–20 years	2.5

Food Sources. Riboflavin is widely distributed in food materials, although the concentrations in many foodstuffs are not necessarily high. One of the very best food sources is milk. Green leafy vegetables contain very considerable quantities of this vitamin, but maturation and drying of the leaves may result in appreciable diminution. Liver, meats, egg white, and yeast are additional sources of value. It is noteworthy that the many seeds such as the legumes which are such excellent sources of thiamine are poor sources of riboflavin. Fruits are considered poor sources of riboflavin while fats and oils are practically devoid of it.

Planning the Daily Diet. The daily quart of milk for the child or the pint for the adult will supply most of the need for riboflavin. An egg or a portion of cheese will furnish up to one fourth of the daily need. Green leafy vegetables should be served daily not only for this vitamin but for other factors as well.

Retention of Food Values. Pasteurizing or drying of milk has little apparent effect on the riboflavin content, but this vitamin's

sensitivity to ultraviolet light may mean a considerable loss in potency if milk is allowed to stand exposed for any length of time. The usual cooking processes or freezing of vegetables do not contribute to destruction of the vitamin. The losses in the cooking of meats have been found to be insignificant by Michelson, Waisman, and Elvehjem.

NIACIN

Discovery. Pellagra, which means rough skin, is a disease which has been known for centuries. Its causes had been variously ascribed to toxic substances present in corn, infection by microorganisms, or toxicity produced by exposure to the sun. Goldberger of the United States Public Health Service, who was assigned to study the problem of pellagra in the South, early noted that the disease was almost always associated with poverty, that it occurred among people who had very limited diets, and that hospital attendants who worked with the patients never contracted the disease. He then performed a classic experiment on twelve prisoners who were promised release in return for their cooperation in eating a diet representative of the poorer classes in the southern states. The diet consisted of sweet potatoes, corn bread, cabbage, rice, collards, fried mush, brown gravy, corn grits, syrup, sugar, biscuits, and black coffee. After a few weeks the prisoners developed headache, stomachache, and general weakness and in about five months the typical dermatitis of pellagra appeared. Goldberger then suggested the existence of a pellagra-preventing (P-P) factor and related it to the B vitamins. It remained for Elvehjem and his coworkers in 1937 to discover the effectiveness of nicotinic acid or niacin, as a curative agent for blacktongue in dogs. Smith, Spies, and others noted dramatic clinical improvement in pellagrous patients who were given niacin.

Chemistry and Characteristics. Pure niacin, which is $C_6H_5O_2N$, occurs in white needle-like crystals. It is soluble in water but is very stable to heat and oxidation; even boiling and autoclaving does not decrease its potency.

Function. Niacin is a component of two enzyme systems: Coenzyme I and Coenzyme II. As such it is involved in intercellular

oxidation, especially in the metabolism of proteins and carbohydrates.

Effect of Deficiency. Pellagra is the disease which is characteristic of a deficiency of niacin. Its early symptoms include fatigue, listlessness, headache, backache, sore mouth, and gastro-intestinal disturbances. As the disease progresses a dermatitis appears which is characterized by its symmetrical distribution on the body; sunlight aggravates it. The nervous system becomes impaired when the disease remains untreated, and the three "D's" — diarrhea, dermatitis, and dementia — are progressive stages of the disease.

Daily Allowances. While the exact needs of the body for niacin are not known, the Food and Nutrition Committee of the National Research Council has suggested the following allowances.

RECOMMENDED DAILY ALLOWANCES FOR NIACIN[1]

	Mg.
Man (70 Kg.)	
Moderately active	15
Very active	20
Sedentary	12
Woman (70 Kg.)	
Moderately active	12
Very active	15
Sedentary	11
Pregnancy (latter half)	18
Lactation	20
Children up to 12 years	
Under 1 year	4
1–3 years	6
4–6 years	8
7–9 years	10
10–12 years	12
Girls, 13–15 years	13
16–20 years	12
Boys, 13–15 years	15
16–20 years	18

Food Sources. The best known sources of niacin are liver, peanut butter, and yeast while lean meat, potatoes, and vegetables are also good sources. Although milk does not contain a high amount, it is important because of its over all composition.

Planning the Daily Diet. The daily need for niacin can be supplied by one portion of liver, or two portions of lean meat, or 100 grams of peanuts. Vegetables make an important contribution since they are eaten in appreciable quantities each day.

Retention of Food Values. The cookery of foods does not result in loss of niacin, except in so far as part of the soluble vitamin may be discarded in cooking waters which are not used. The refinement of cereals such as wheat, however, leads to a loss of 80 to 90 per cent of the niacin.

PANTOTHENIC ACID

Discovery. While engaged in a study of the nutrients necessary for yeast growth, R. J. Williams and his associates discovered an acid so widespread in its occurrence that they named it pantothenic acid which comes from the Greek word meaning "from everywhere." Then in 1939 Woolley, Waisman, and Elvehjem, and Jukes independently showed that the "filtrate factor" which prevented or cured chick dermatitis was the same as pantothenic acid.

Chemistry and Characteristics. The formula for pantothenic acid is $C_9 H_{17} NO_5$. Calcium pantothenate in its pure form is a white crystalline compound which is bitter to the taste. It is easily destroyed by dry heat and alkali, but it is more stable to moist heat.

Functions and Effects of Deficiency. The manner in which pantothenic acid functions is still an unanswered problem, although it seems likely that it is concerned in cell respiration. Recent work indicates that it may be of importance in the digestion and absorption of carbohydrates and fats. Diets deficient in this factor have led to many interesting symptoms in animals such as dermatitis in chicks, graying of hair in young black rats, and sudden collapse in dogs. Many extravagant claims have been made for calcium pantothenate as a corrective factor for graying of human hair. The experiments of Kerlan and Herwick on 21 women and six men with graying hair showed that 20 milligrams of calcium pantothenate daily did not bring about any change in the hair color over a six months period. The conclusions in Nutrition Reviews are: "It has not yet been determined that the human diet is deficient in pantothenic acid as a single factor or even that pantothenic acid deficiency occurs in man."[5]

Sources. Liver is one of the best sources of pantothenic acid. Other good sources include milk, cereals, meat, yeast, legumes, and eggs.

BIOTIN

Discovery. One of the most interesting stories in the realm of vitamin research is that which concerns the discovery of biotin. Egg white injury was described many years ago by workers in various laboratories who found that rats developed a characteristic dermatitis when they were fed a diet in which raw egg white was the sole source of protein. There was also loss of weight, falling out of hair, nervous disturbances, loss of muscular control, and eventual death of the animals. Dr. Parsons and her coworkers made noteworthy contributions to this study by finding that cooked egg white did not produce the injury, and suggesting that some substance in raw egg white combined with the protective factor in the digestive tract so that the latter could not be absorbed. The substance responsible for the toxicity was later identified as a protein, avidalbumin, which means "hungry" albumin; the name for this material was then shortened to avidin. The factor in foods which prevents the egg white injury was named vitamin H by György.

Biotin had long been recognized as an essential factor for the growth of micro-organisms, and in 1936 it was first isolated by Kögl and Tönnis. Then in 1940 du Vigneaud and his associates established the identity of biotin, vitamin H, and coenzyme R.

Chemistry and Characteristics. Biotin, $C_{10}H_{16}O_3N_2S$, is extremely stable to prolonged heating in the presence of acid, but is slowly destroyed in alkaline solutions if it is in the pure form. As it occurs in nature it is also stable to the effects of alkali. While biotin in its pure form is water soluble, it is not easily extracted from foods since much of it occurs in a "bound" state. It is quickly destroyed by certain oxidizing agents.

Functions and Effects of Deficiency. Biotin is the most potent vitamin yet isolated. For example, as little as one part in 400 billion is sufficient to stimulate normal yeast growth. It is essential for all cell respiration but its exact functions are not yet known. One of the very interesting things about this vitamin is the fact that intestinal bacteria can synthesize it just as they are able to manu-

facture vitamin K. As a matter of fact, the rate of synthesis is greater than the amount supplied in the diet itself. According to a recent review: "It is highly improbable that a deficiency of biotin can occur unless the flora of the intestinal tract is drastically altered or unless a highly artificial diet is taken which provides sufficient egg white (or avidin) to bind the biotin and prevent its absorption."[6]

Dermatitis has been described in monkeys and rabbits which were fed egg white in sufficient quantities to bind the biotin in the intestine. Sydenstricker has recently reported the occurrence of a characteristic deficiency disease in human beings who ate diets which were low in biotin and which were supplemented with 200 grams of dried egg white daily. The symptoms appeared in a few weeks and included dermatitis of the arms and legs, nervousness, loss of appetite, anemia, and grayish skin pallor. The daily inclusion of 150 to 300 micrograms of biotin corrected the outstanding deficiency in these subjects.

Sources. Although biotin occurs in extremely minute amounts in foods its distribution is wide. Its content in foods is now determined by means of techniques requiring yeast growth, or acid production by Lactobacillus casei. The chief sources are milk, egg yolk, liver, kidney, and yeast.

PYRIDOXINE OR VITAMIN B_6

The factor which is concerned in the prevention of acrodynia, or dermatitis in rats was first called vitamin B_6. The rats which received diets deficient in this vitamin showed reddening and swelling of the nose, the tips of the ears, and the paws. Pigs, chicks, and dogs have shown somewhat different symptoms when the diets were deficient in vitamin B_6. This vitamin has been synthesized and is now known as pyridoxine, the formula being $C_8H_{10}O_3N$. It is relatively stable to heat.

Not a great deal is known about the possible role of pyridoxine in human nutrition. It may be related to the utilization of the unsaturated fatty acids. Spies and his associates found that certain symptoms such as nervousness in pellagrins were corrected only by the administration of vitamin B_6. There have also been indications

of beneficial effects in muscular dystrophy and paralysis agitans when the pyridoxine intake was increased. The requirement for pyridoxine is not known, but no doubt adequate intakes are assured if the diet contains liberal quantities of the other B complex factors.

Yeast, meats and fish, cereals, legumes, milk, and vegetables are good sources of pyridoxine.

OTHER B COMPLEX VITAMINS

Choline. Chemists have known of choline for many years but Dr. Best was the first to show that this substance was necessary in the prevention of fatty livers in dogs which had been depancreatized. Choline has thus become another member of the B complex, and no doubt will prove to be important when its true functions are clarified. This vitamin is quickly destroyed in the presence of alkali.

Choline is related to the metabolism of fatty acids, and its absence in the diet of experimental animals leads to accumulation of fat in the liver. Until functions and methods of measurement have been more exactly determined, it will not be possible to estimate the daily need. Meat, eggs, cereals, and vegetables, being good sources of lecithin, are also considered to be good sources of choline since the latter is part of the lecithin molecule.

Para-aminobenzoic acid has been an effective cure for graying of hair in rats which had received a diet deficient in this factor but adequate in pantothenic acid. More work is necessary to establish this substance as a true vitamin.

Inositol is a tentative member of the B complex. Its empirical formula is the same as that of glucose, although its structure is quite different. It occurs in muscle, blood cells, and brain, but its functions are not known. Seeds are very good sources of this factor.

Additional B complex Vitamins. There are other factors about which little is known concerning the applications to human nutrition. They include: folic acid also associated with graying of hair in rats; vitamin M which is needed to keep the blood of monkeys in normal condition; the "grass juice" factor which guinea pigs require for growth.

SUMMARY OF THE WATER-SOLUBLE VITAMINS

CHARACTERISTICS	FUNCTIONS	EFFECT OF DEFICIENCY	SOURCES
ASCORBIC ACID OR VITAMIN C Most labile of all the vitamins; oxidized by light, air, alkali, heat, enzymes Copper and ferrous iron increase destruction Acid inhibits destruction *Physiology* Storage in body is limited Greatest concentrations in most active tissues	Form and maintain intercellular substance Increase resistance to infection	Cutaneous hemorrhages Improper bone development Weakened cartilage Anemia Muscle degeneration Stunted growth Susceptibility to infection Scurvy	Citrus fruits Tomatoes Potatoes Raw leafy vegetables Fruits
THIAMINE OR VITAMIN B_1 Stable in dry form Destroyed by alkali, bacterial action, sulfites *Physiology* Storage in body is limited	Utilization of carbohydrate Normal appetite Normal gastro-intestinal motility Normal heart action Nervous stability	Lack of appetite Nervous irritability Depression Fatigue Gastro-intestinal atony and constipation Beriberi, if deficiency is severe; polyneuritis, edema, and cardiac symptoms	Wheat germ Brewer's yeast Whole-grain cereals Legumes Pork Glandular meats Peanuts Leafy vegetables Fruits
RIBOFLAVIN OR VITAMIN B_2 Oxidized by light Resistant to heat, except in presence of alkali *Physiology* Limited storage Supplies carefully guarded in the body	Oxidation in all body cells Normal skin tone and digestion Longer "prime of life"	Fissures at corners of mouth Inflammation of the cornea Burning and itching sensation in eyes Photophobia Soreness of lids	Milk Green leafy vegetables Eggs Liver and other meats Brewer's yeast

SUMMARY OF THE WATER-SOLUBLE VITAMINS (*Continued*)

Characteristics	Functions	Effect of Deficiency	Sources
Niacin or Nicotinic Acid Stable to heat and oxidation	Intercellular oxidation, especially in metabolism of protein and carbohydrate	Pellagra Fatigue Sore mouth Diarrhea Dermatitis Nervous manifestations leading to dementia.	Liver and other meats Brewer's yeast Peanut butter Milk Green leafy vegetables

PROJECTS

1. Calculate the percentage of your own daily requirement for thiamine, riboflavin, niacin, and ascorbic acid which 500 grams of milk would supply. In each case list two foods which would be excellent supplements to the milk in supplying your daily needs.

2. Calculate the amounts of each of the following foods necessary to furnish 25 milligrams of ascorbic acid: orange juice, tomato juice, sweet potato, cabbage, grapefruit, endive, strawberries, cantaloupe, milk, white potatoes, apple, and lettuce.

3. From current market prices determine which of the foods listed in problem 2 will supply 25 mgms. at the least cost.

4. Calculate the thiamine, riboflavin, niacin, and ascorbic acid contents of the essential foods listed on page 131.

REVIEW QUESTIONS

1. The student should be prepared to answer these questions relative to ascorbic acid, thiamine, riboflavin, and niacin.

   a. What is the chief function of each vitamin?

   b. What changes take place in the body whenever a deficiency occurs?

   c. What is the unit of measurement?

   d. What is your own daily requirement?

   e. What factors influence the requirement for each vitamin?

   f. Which foods supply the daily needs for each vitamin?

   g. On the basis of chemical characteristics, what rules can be formulated for preparation so that maximum vitamin content will be retained in the food?

   h. What is the characteristic disease which occurs as a result of severe deficiency?

2. Why is it necessary to allow vitamins in excess of that needed to prevent characteristic deficiency diseases?

3. Name nine members of the vitamin B complex.

4. State Sherman's rule for insuring adequate intake of the vitamins and minerals.

5. Why is a dietary deficiency of biotin unlikely?

6. Under what conditions might a deficiency of biotin be possible?

7. What is avidin?

8. What is the possible significance of each of the following in human nutrition: choline, pyridoxine, pantothenic acid, inositol.

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CHAPTER IX

Water and Cellulose

WATER

Water is the most important single item of the dietary, and the body's need for it is second only to the necessity for oxygen. It is possible to live for days and even weeks without food, but death is likely to follow a deprivation of water in from sixty to seventy-two hours. There are two outstanding reasons why the body must have a sufficient supply of fluids. First, all the chemical changes which occur in the cells of the body take place in the presence of water. Second, the blood which is about 90 per cent water carries nutritive elements to the cells and removes the waste products of metabolism.

Approximately 70 per cent of the total body weight is made up of water. Fluid within the cells (intracellular fluid) accounts for 50 per cent of the total mass. The circulating plasma is about 5 per cent of the body weight and the remaining 15 per cent consists of interstitial fluid (lymph, and fluid which bathes the tissues).

Functions. Chemical reactions within the body are possible only in the presence of water. It is the medium of the body fluids, the secretions, and the excretions — blood, lymph, digestive juices, bile, perspiration, urine, and feces. Water acts as a solvent for all the products of digestion, holding them in solution and permitting them to pass through the absorbing walls of the intestinal tract into the blood stream. These products are then transported to the different parts of the body. Water, together with the mineral salts and protein present therein, is responsible for the interchange of materials which takes place between the blood and cells, and for the regulation of water balance.

Without a fluid medium it would be impossible for waste material to leave the body. Again, the blood is the vehicle for carrying carbon dioxide to the lungs and waste nitrogenous material and

salts to the kidneys. Urine which consists of about 97 per cent water holds the waste materials in solution, while bowel wastes can be eliminated only if sufficient water is present to avoid constipation.

Water is also an important lubricant for its avoids friction between moving body parts. It regulates body temperature through evaporation from the skin and lungs.

Sources of Water to the Body. There are three sources of water to the body: (1) water as such; (2) water contained in foods; (3) water formed by oxidation of foodstuffs in the body.

All foods, even those which are considered to be "dry," contain appreciable quantities of water. The following table gives an approximation of the amounts which are present in the more common food materials.

WATER

	per cent
Milk	87
Eggs	74
Meat	40–75
Fruits and vegetables	70–95
Cereals	8–20
Bread	35

The average daily diet may contain roughly 1000 cc. of water.

The amount of water which is released in the metabolism of foods has been estimated by Magnus-Levy[1] to be as follows:

AMOUNT OF WATER FORMED IN OXIDATION OF FOODSTUFFS

100 Gm. of fat	give 107.1 Gm. of water
100 Gm. of starch	give 55.5 Gm. of water
100 Gm. of protein	give 41.3 Gm. of water

For an average mixed diet this will approximate 300-450 cc. daily.

Avenues of Water Loss from the Body. All the wastes from the oxidation of the nitrogenous part of the protein and from excess mineral salts are eliminated in the urine. The daily urinary volume may vary from 500 to 2000 cc. The fecal excretion results in an additional loss of 100 to 300 cc. of fluid.

A constant loss of water takes place from the skin and lungs through evaporation. The normal daily elimination under conditions of moderate activity and climate is about 1000 cc. According to Talbott[2] as much as 10 to 15 liters of sweat may be lost in eight hours if an individual is working hard in a hot environment.

Water Balance. The importance of keeping the body in fluid balance is universally recognized. The body is said to be in water balance when the available water equals that of the water excreted or lost from the body. Newburgh[3] illustrates this in the following table:

NORMAL WATER BALANCE

Available Water	Grams	Excreted Water	Grams
Water intake as such	1100	In urine	1000
Water in diet	900	In stool	200
Water formed by oxidation (metabolism)	200	In vapor (skin and lungs)	1000
Total	2200	Total	2200

Abnormal loss of water occurs from prolonged vomiting, as in pernicious vomiting of pregnancy, postoperative vomiting, and in malnutrition of infants. Hemorrhage, prolonged diarrhea, protracted fevers, excessive perspiration, burns, and uncontrolled diabetes mellitus may bring about great losses of water from the body. A loss of 10 per cent of fluid from the body represents a serious menace to health. It may lead to poor absorption of food, vomiting, diarrhea, elevation of temperature, circulatory failure, and impairment of renal function. A case of intestinal obstruction with dehydration illustrates a negative balance of 1,275 grams of water.

CASE OF DEHYDRATION[3]

Available Water	Grams	Excreted Water	Grams
Water intake as such	3000	In urine	700
No food retained	0	In stool	750
Water formed by oxidation (metabolism)	425	In vapor	1000
		Emesis	1500
		Drainage	750
Total	3425	Total	4700

To compensate for abnormal losses of water from the body the intake may be increased (1) by beverages, broth, ices, etc., (2) by subcutaneous saline and glucose solutions, (3) by intravenous solutions, or (4) fluid by rectum. Talbott emphasizes the importance of adequate salt intake with the water in cases of thirst accompanied with dehydration since a deficiency of both usually exists.

Daily Allowances. As a rule the intake of water should be from 6 to 8 cups per day. This may be in the form of drinking water or beverages. A moderate amount of water with meals is not objectionable. However, it should not be used as a substitute for mastication by washing down food before it is properly disintegrated. The temperature at which fluids are taken may be governed by individual tastes since there is little evidence that cool water is harmful. It is imperative that persons who are subject to excessive perspiration in hot weather partake liberally of fluids and of salt.

CELLULOSE

Cellulose is a body-regulator and plays an important part in the maintenance of good health.

Composition and Characteristics. Cellulose, a woody fibrous material, is the solid constituent of plants which furnishes their skeletal tissue. In other words, cellulose is to the plant what bones are to the body. It gives to the individual plant and its various parts their characteristic shape and form.

Cellulose is classified as a carbohydrate; but since it cannot be reduced to simple sugar by human digestion, it must be considered as indigestible residue or unavailable carbohydrate. It is insoluble in hot or cold water, though the fiber may be softened and broken up into smaller pieces. It absorbs moisture from the intestinal contents, swells, and increases their bulk.

Digestion. There is no chemical change in cellulose in the human digestive tract. Some of the tender fibers of young plants may disappear during their passage down the tract, but this is probably due to the action of bacteria rather than to the action of enzymes. During the process of digestion of foods, tough fibers such as skins of fruits and vegetables or the outer coating of the cereal grains are softened by coming into contact with acids in the stomach. They

are not dissolved but are broken into smaller pieces as the result of muscular contractions of the walls of the stomach and intestines, and they pass unchanged down the tract. The cellulose in cooked food retains less water than that in food in an uncooked form. For example, the cooked vegetables used in salad combinations carry less water to the colon than the raw vegetable combinations; but both are good sources, and in some instances the use of uncooked vegetables is forbidden. The bulk furnished to the food mass stimulates peristaltic action throughout the entire tract, from the esophagus through the rectum.

Function. Much of the food eaten is digested and absorbed. The organic nutrients leave very little residue after they have been acted upon by the enzymes in the digestive tract. To this small amount of residue are added the remains of digestive juices, dead cells, and bacteria. Even then, the amount is small and consequently affords little stimulation to peristaltic movement in the intestines without the accompaniment of some substance to give it bulk. The chief function of cellulose is to contribute this bulk which enables the mass to pass down the tract at a normal rate of speed, thus preventing a stagnation of material in the colon and providing good elimination. The characteristics of cellulose which help to prevent constipation are that as it absorbs moisture it increases in bulk and that it fails to give up all the moisture as it passes through the upper part of the colon. This prevents the fecal mass from becoming hard and dry and difficult to evacuate. Agar-agar, a material from sea algae, closely related to cellulose, has a particular characteristic. It differs from cellulose in that it will form a thick solution in water when boiled and will gel on cooling. Like cellulose, it absorbs water and will not give it up, thus aiding easy evacuation.

Daily Allowances. The amount of cellulose required to assure one normal bowel movement a day is believed to be from 5 to 6 Gm. A diet low in cellulose — that is, one made up chiefly of meat, potatoes, concentrated sweets, and bread — is likely to cause atonic constipation. If the movement of the food mass in the tract is sluggish and its passage is delayed too long, the unabsorbed material becomes a breeding ground for bacteria, and the results may be disastrous. To prevent this, the amount of indigestible material in the diet must be sufficient to provide the necessary bulk to stimu-

late peristalsis down the tract and so prevent undue delay in the evacuation of the feces.

An already constipated colon requires a double allowance of cellulose in the diet. An excess of cellulose in the diet, however, will delay the emptying time of the stomach; and in cases of an excessive flow of acid, as in gastric ulcer, it will not only increase the acid flow still further but will also irritate the ulcerated surface. When the acid secreted in the stomach is too low, as in pellagra, sprue, etc., the presence of too much cellulose increases fermentation of food staying overtime there. A high cellulose intake over a protracted period of time may give the same results as a long-continued taking of laxatives; namely, spastic constipation.

Selecting the Day's Food for Cellulose. The average mixed diet, in which leafy vegetables, fruits, and cereals not too highly milled are included, will be likely to contain the necessary amount of indigestible residue. Cellulose from fruits and vegetables, whole-grain cereals, and dark breads is more advisable than large amounts of straight bran. When bran is resorted to for the correction of constipation it should be the specially prepared type which is finely ground and should be administered in moderate amounts. This will furnish the bulk without irritating the tender membranes lining the colon. The following outline demonstrates the way in which the individual, in making up the daily diet, may select the foods to obtain the proper amount of cellulose. This need not represent all the cellulose in the diet, because most vegetables and fruits are

DAILY CELLULOSE REQUIREMENT

Food	Wt. in Gm.	Size of Portion	Cellulose, Approx. Gm.
Breakfast cereal: oatmeal (dry) or equivalent......	30	⅔ cup after cooking......	0.5
Whole-wheat bread	100	3½ slices ½ in. thick.....	1.2
1 serving raw vegetable (tomato)	100	1 medium (not peeled)...	1.1
1 serving cooked vegetable (fresh green peas).......	100	⅔ cup after cooking......	2.0
1 serving fruit (apple)	100	1 small (not peeled)	1.1
Total.......	....	....	5.9

fairly good sources of fiber, but it will provide the amount considered necessary to assure one satisfactory bowel movement each day.

PROJECTS

1. List 10 foods which are high in water content and 10 foods which are low in water content.

2. List 10 foods which are high in cellulose content and 10 foods which are low in cellulose content.

REVIEW QUESTIONS

1. About 70 per cent of the body weight is water. Into what 3 divisions is this water placed?
2. Name six functions of water.
3. What are the three sources of water to the body?
4. What is meant by "water of oxidation"?
5. What is the approximate water content of milk, oranges, bread, potatoes, cooked beef?
6. Name the avenues of water loss from the body.
7. What is meant by water balance?
8. Under what conditions may dehydration occur? How may it be corrected?
9. State the normal daily requirements for water.
10. Is drinking water with meals harmful?
11. What is cellulose? What characteristics does it have?
12. Describe the changes which take place in cellulose during digestion.
13. What is the main role of cellulose in the diet?
14. What is agar-agar? How is it used?
15. What is the daily requirement of cellulose? List several foods which should be included daily to insure adequate cellulose intake.
16. When is the need for cellulose increased?
17. What are the dangers of excessive intake of cellulose?

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CHAPTER X

Digestion and Absorption

The need for the various nutrients by the body has been established. The preceding chapters have also touched upon the processes of digestion, absorption, and utilization. It is necessary, however, to correlate these facts since no diet is made up of a single purified nutrient. The following discussion is intended primarily as a review of material which the student has gleaned from earlier chapters or in a course in physiology. Any good textbook in physiology will supply additional details.

Digestion is the process of breaking down foods into small units of structure so that absorption can take place from the intestinal wall into the blood stream.

The Nature of Enzymes. Enzymes are catalytic agents of a protein nature which are manufactured by specialized living cells, and which have the power to produce chemical changes in other substances. They are highly specific substances; that is, an enzyme which splits sugar cannot digest protein, nor can an enzyme which splits fat have any effect on sugar. They are extremely powerful in their action, for a small amount of them can accomplish very difficult chemical changes. Even more surprising is the fact that the enzyme acts on a substance without itself being changed. Every enzyme has a specific temperature at which it works, those in the body being most efficient at body temperature. They become quite inactive in cold temperatures, but are entirely destroyed by heat. Moisture is necessary for their activity. Some enzymes, as pepsin, work only in an acid medium while others, as trypsin, work only at an alkaline reaction. Most enzymes take their name from the substance upon which they act, the ending *ase* being added to the root word. For example, lactase derives its name from the sugar upon which it acts — lactose. The enzymes of digestion with which we are concerned here are secreted by the glands in the mouth,

the stomach, the small intestines, and the pancreas. The following table summarizes them.

ENZYMES IN DIGESTION[1]

Secreted in	Name of Enzyme	Substance Digested by Enzyme	Products of Digestion
Saliva	amylase	starch	dextrins, maltose
	maltase	maltose	glucose
Gastric juice	lipase	tiny particles of fat	fatty acids, glycerol
	pepsin	protein	breakdown products of protein
	rennin	milk protein	milk curds
Pancreatic juice	amylase	starch	dextrins, maltose
	erepsin*	protein substance	amino acids
	lactase	lactose	glucose, galactose
	lipase	fat	fatty acid, glycerol
	maltase	maltose	glucose
	sucrase	sucrose	glucose, fructose
	trypsin	protein and breakdown products of protein	combined amino acids and single amino acids
Intestinal juice	amylase**	starch	maltose
	enterokinase***		
	erepsin*	protein substance	amino acids
	lactase	lactose	glucose, galactose
	lipase	fat	fatty acids, glycerol
	maltase	maltose	glucose
	sucrase	sucrose	glucose, fructose
	three enzymes which break down nucleus of cells	nucleus of cells	phosphoric acid, purine bases, sugar

*actually two enzymes
**amylase also converts glycogen to glucose
***activates trypsin and erepsin

Digestion in the Mouth. Food in the mouth is cut and ground into smaller pieces by the teeth. It undergoes chemical changes in the mouth as a result of salivary digestion. The juices in the mouth are secreted from three pairs of salivary glands. These juices are neutral or slightly alkaline in reaction and are secreted in quantities of about 1500 cc. daily. Saliva is made up of water, mucin, inorganic salts, and enzymes known as amylase and maltase which

act on starch and maltose, respectively. The flow of juices in the mouth is stimulated by (1) mastication, especially of crisp, hard food which requires chewing and (2) the psychic factors, sight, taste, odor, and memory of agreeable foods. These two factors are important in bringing about good digestion.

Saliva serves four important purposes in digestion: (1) it moistens and softens the food, thus assisting in mastication; (2) the mucin of the saliva lubricates and assists the food in its passage down the esophagus; (3) the amylase acts upon the starch, especially cooked starch, and changes it to the sugar, maltose; (4) the appetite juice flowing from the cells in the mouth serves to stimulate the secretory cells of the stomach, thus hastening the digestion of food there.

The food does not remain in the mouth long enough to become completely liquefied but is softer and more easily swallowed. Peristaltic constrictions occur in the walls of the esophagus which propels the mass into the fundus of the stomach where it is held for a period. There is not a great deal of chemical change brought about even in the starches during the stay in the mouth, owing to the limited time they remain there, but the action of the amylase will continue for a time in the stomach until stopped by the acid.

Digestion in the Stomach. The fundus of the stomach serves as a reservoir for food coming in from the mouth. As there is little movement in this part of the organ, digestion of starch which was begun in the mouth is continued here. The food remains in the fundus from ½ to 2 hours.

Food coming into the stomach expands the stomach walls, and each addition pushes the mass preceding it forward toward the central part of the organ, where small contractions begin and run toward the pylorus. These contractions are regular and increase in strength as digestion progresses. As a result, the food is broken up still further, mixed with the gastric juices and finally reduced to a thin souplike composition called chyme. The deep peristaltic wave which carries the food toward the pylorus has its beginning in the central portion of the stomach. The pyloric valve which separates the stomach from the small intestine is controlled in the beginning by the presence of free acid. The emptying time of the stomach depends upon the character, type, and amount of food eaten. Liquids begin to leave the stomach in from 15 minutes to

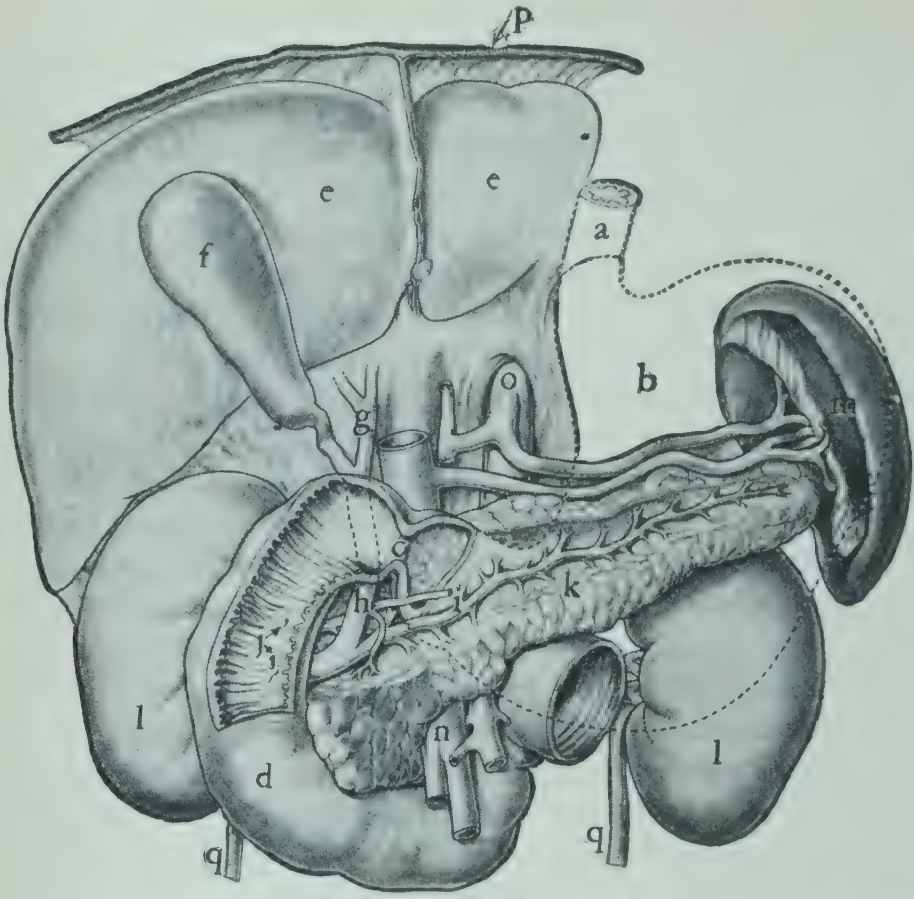

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FIG. 17. Organs of the upper abdomen concealed by stomach and intestines: (*a*) Esophagus; (*b*) Stomach shown by dotted lines; (*c*) Valve between stomach and small intestines; (*d*) Section of small intestine known as the duodenum; (*e*) Liver, raised in order to expose organs; (*f*) The gall bladder, a reservoir for bile; (*g*) Canal which carries bile directly from liver to small intestine; (*h*) Canal which carries bile from both the gall bladder and liver to the small intestine; (*i*) Canal which carries pancreatic juice to small intestine; (*j*) Opening of canals from liver and pancreas; (*k*) Pancreas, showing cross section; (*l*) Kidneys; (*m*) Spleen, the graveyard of red blood corpuscles; (*n*) Vein which carries the blood from the intestines to the liver; (*o*) Artery which carries blood from the heart to the digestive organs; (*p*) Diaphragm; (*q*) Canal from kidney to urinary bladder.

½ hour. A normal stomach should empty itself in from 4 to 6 hours. A small test meal should pass out of the stomach in from 1 to 4 hours. Longer than 7 hours emptying time indicates impairment of tone and motility.

Chemical changes in the stomach are brought about by the action of the gastric juice, which is secreted by the cells in the stomach

walls. This juice is made up of water, mucin, hydrochloric acid, inorganic salts, some protein, and the enzymes rennin and pepsin. The amount of gastric juice secreted depends upon the amount of food to be digested. Gastric juice has a strong acid reaction, hydrochloric acid occurring in about 0.2 per cent in normal juice. Hydrochloric acid serves several purposes in digestion: (1) it swells the protein, making it more easily acted upon by the enzymes; (2) it acts as an activating agent to the enzyme pepsin; (3) it assists in the inversion of cane sugar, making the disaccharide more easily convertible into the monosaccharides in the intestine; (4) it serves as a disinfectant, destroying some of the bacteria which enter the stomach with food; (5) it acts as a controlling agent by means of which the pyloric valve opens (in the early stages of digestion), allowing a small portion of the acid chyme to pass into the duodenum. Hydrochloric acid is secreted chiefly by cells located in the central region of the stomach. Food reaching this part of the organ comes in contact with the acid. The amylase, which has been able to continue to act upon the starches for a time while held in the fundus, ceases its action when brought in contact with the acid. Protein is the only nutrient undergoing peptic digestion.

Rennin acts only on the protein of milk, changing the soluble protein into insoluble casein, preparing for its digestion by the regular protein-splitting enzyme, pepsin. As soon as the proteins in the stomach's contents become saturated with acid, they are acted upon by the pepsin secreted largely by cells located in the pyloric end of the stomach and are changed to proteoses and peptones in which form they pass out of the stomach. When digestion is at its height during the latter part of the time in the stomach, proteins may pass into the duodenum without being acted upon at all by pepsin and must be broken down entirely after reaching the small intestine. Fermentative bacteria inhabit the stomach to a certain extent, but under normal conditions their action is limited by the acid which acts as a germicidal agent. Excessive amounts of carbohydrate in the form of sugar in the diet favor the development of fermentative bacteria in the stomach.

Digestion in the Small Intestine. There are two types of movement in the small intestine: (1) peristaltic waves, (2) rhythmic segmentation. Peristaltic waves carry the food mass slowly down

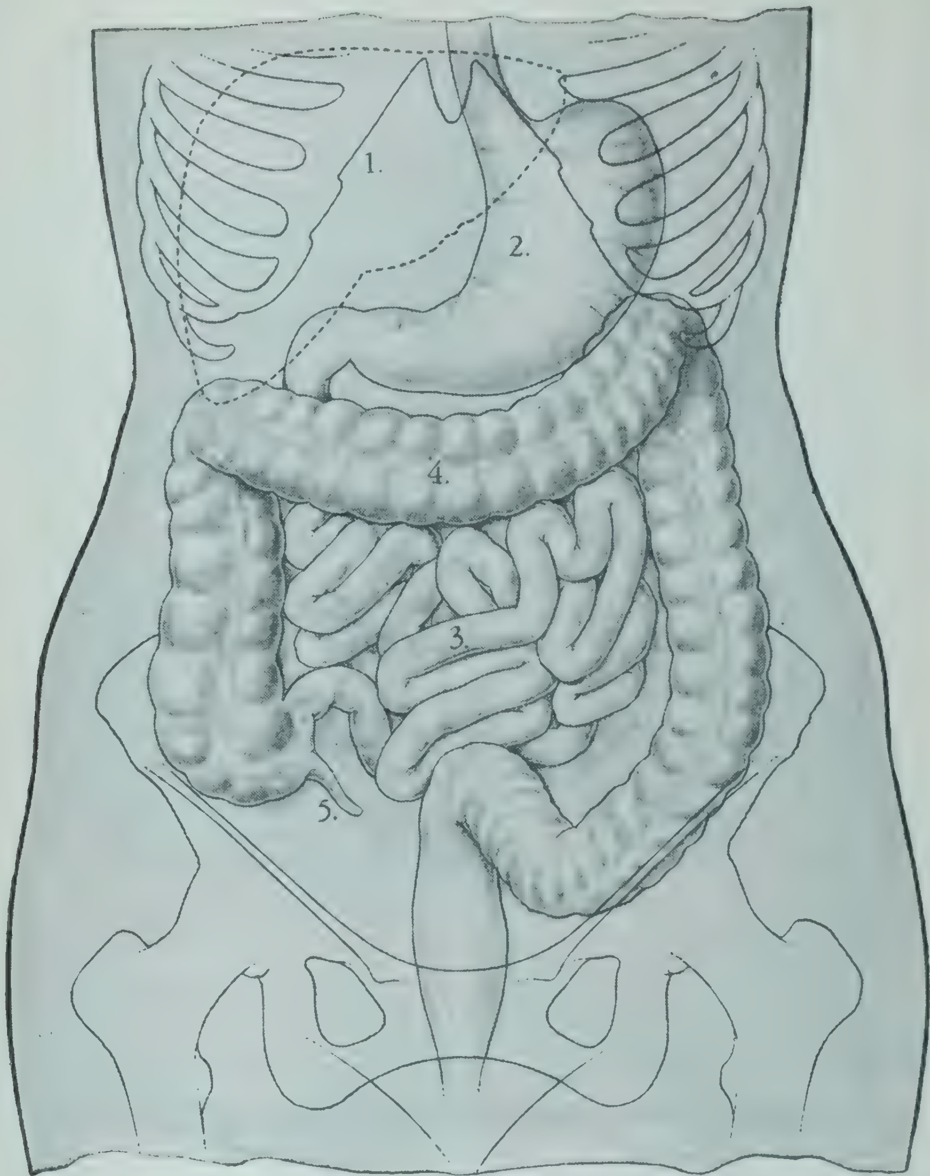

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Fig. 18. Diagram of the digestive tract: (1) Liver, shown by dotted line; (2) Stomach; (3) Small intestine, about 24 feet in length in normal adult; (4) Large intestine, about 4 feet in length; (5) Appendix.

the tract, while the segmentary wave divides the food mass into segments. This process not only serves to mix the food with the juices, allowing the enzymes free access to the nutrients present, but also spreads the digested materials over a large portion of the absorbing intestinal wall. The unabsorbed contents of the small intestine begin to pass through the ileocecal valve (the valve divid-

ing the small from the large intestine) in from 2 to 5½ hours. It requires 9 hours or more for the last of a large meal to pass into the large intestine. This includes the time the food remains in the stomach. Cellulose, by reason of the pressure it exerts upon the intestinal walls, has a tendency to stimulate peristalsis, thus promoting elimination of waste material.

Digestion in the small intestine is the result of the action of the enzymes secreted in the pancreatic and intestinal juices. Hydrochloric acid in the chyme passes through the walls of the duodenum and is used for the manufacture of the hormone secretion which acts as a stimulating agent to the secretory cells of the pancreas, intestines, and liver.

Pancreatic juice contains many enzymes, the chief of which are: trypsin, which splits protein into peptones and amino acids; amylase, which splits starch to the sugar maltose; and lipase or steapsin, which splits fats to fatty acids and glycerol.

Intestinal juice contains one protein-splitting enzyme, erepsin, which splits peptones to amino acids, and three sugar-splitting enzymes: maltase, splitting maltose to glucose; sucrase (invertase), splitting sucrose to glucose and fructose; and lactase, splitting lactose to glucose and galactose.

Glycerine, from the fats, is soluble in water and is dissolved in the intestinal contents; but fatty acids are emulsified with the bile from the liver, forming a soaplike mixture. Bile is an important factor in the absorption of fats and fat-soluble vitamins because it lessens the surface tension between oily and watery fluids, allowing them to form a homogeneous mass in the intestinal tract which favors absorption.

The bacteria existing in the intestinal tract are both fermentative and putrefactive in type. These organisms do no harm unless they develop in abnormal numbers. By far the greater number of bacteria occur in the large intestine.

Functions of the Large Intestine. The cecum fills slowly, and the waves which carry the mass toward the rectum, together with the antiperistaltic waves which force it back, spread the mass over the absorbing walls of the large intestine, thus giving the unabsorbed material an opportunity to pass through the walls of the large intestine. Most of the absorption which occurs here is that of water.

Emptying time of the large intestine depends upon the amount and type of food eaten. Concentrated foods leaving little residue stay a longer time in the colon than foods rich in cellulose, the increase in bulk acting as a stimulus to the muscular contractions which constitute evacuation or normal bowel movement.

There are no enzymes of digestion in the large intestine; the secretions there show much mucin and are alkaline in reaction.

Factors Affecting Digestion. The term "digestibility" generally refers to the rapidity with which food leaves the stomach rather than the completeness of its digestion. Therefore, anything which either speeds up or slows down the emptying time of the stomach may be considered as an influencing factor in digestion. There are a number of such factors, the most important of which will be briefly outlined here.

Consistency, Division, and Type of Food. Foods which need little if any breaking up before they are ready to be absorbed may be said to be readily digestible. For example, liquids leave the stomach rapidly and are more quickly available for absorption than are foods requiring mechanical division. Mastication plays an important part in digestion because when thoroughly done it stimulates the flow of saliva, which softens the finely divided food and makes it accessible to the action of the enzymes which occur in the digestive juices. The amount and type of food taken at one time affect digestion. Fats digest slowly and when taken with other foods have a tendency to retard their digestion also. Of the carbohydrate foods, those rich in sugar digest quickly and completely, leaving no residue in the intestinal tract, while the starchy foods, though almost completely absorbed, pass through the tract more slowly. Foods rich in cellulose digest more slowly than those free from fiber, the cellulose itself not being digested at all. Cellulose adds bulk to the food mass, however, and stimulates its passage down the tract.

Bacterial Action. Bacteria of various types inhabit the human alimentary tract shortly after birth and become so firmly established therein that they are considered almost a part of it. The types most commonly found are (1) fermentative, (2) putrefactive, and (3) bacteria of coli type. The latter exhibit characteristics of both the other types. Under normal conditions, these organisms cause no

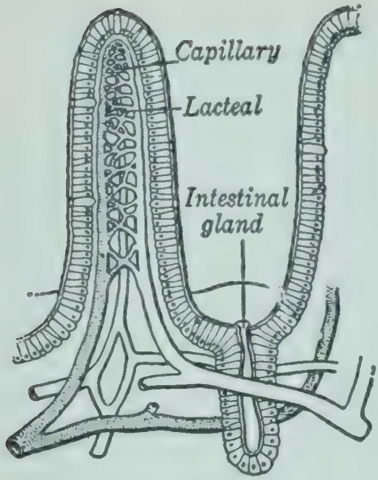
trouble; but when the fermentative bacteria become too numerous, excessive fermentation occurs, especially in the stomach, and when too much of the protein from food remains unabsorbed, it furnishes a fertile field for the development of putrefactive bacteria.

Chemical Factors. There are certain chemical factors which stimulate the flow of juice in the stomach — strong acids, meat extractives, etc.; others, such as fat, retard the flow. These factors have a definite significance in certain pathological conditions of the gastro-intestinal tract.

Psychical Factors. The factors of anger, fright, or worry delay digestion by reason of their depressing effect upon the secretions. The first two emotions take immediate effect, slowing down or even stopping temporarily the process of digestion, while worry is probably responsible for a more lasting as well as more detrimental effect because it interferes with general nutrition by depressing normal appetite. On the other hand, the pleasant reaction brought about by the sight, smell, and taste of palatable food, stimulates the nerves and causes a flow of juice in the mouth known as "appetite juices." These juices are actively responsible for the early appearance of gastric juice in the stomach; and while digestion in that organ will take place without the assistance of the mouth secretions, it is undoubtedly true that the latter hastens the process.

Absorption of Food. Almost all of the soluble nutrients are absorbed from the small intestine. The four or five million *villi,* or tiny finger-like projections which constitute the walls of the small intestine, give an enormous area from which absorption can take place. Each villus is supplied with capillaries, and lacteals which are part of the lymphatic system. The almost continuous contractions of the intestinal wall force the blood and lymph containing the nutrients into the general circulation, while relaxation allows fresh blood and lymph to flow in to collect more nutrients.

Utilization of Food. The capillaries carry the products of carbohydrate digestion into the liver and muscles, where they are converted into glycogen to be used as fuel. The products of fat digestion—carried by the lacteals—recombine to form neutral fat before they pass into the lymph circulation. The greater portion of fat passes into general circulation by way of the thoracic duct and left subclavian vein. The capillary blood vessels also carry the amino



Section of a villus.

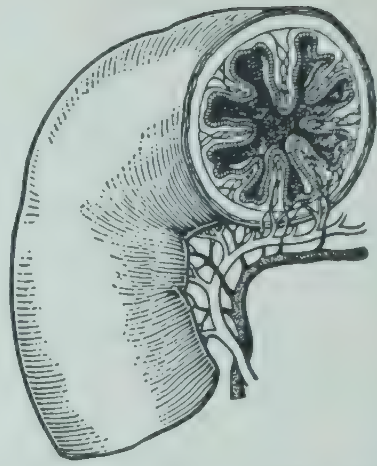


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FIG. 19.

A cross section of the small intestine. The villi are much magnified.

acids to the liver and other tissues. Unused amino acids are deaminized; that is, the nitrogen part is changed chiefly to urea for elimination in the urine, the second part is utilized and eliminated as any other carbohydrate, while the third part functions as fat and is eliminated as an end product of fat metabolism.

PROJECT

Make an outline which shows the steps in the digestion, absorption, and utilization of a meal consisting of poached egg on toast. Indicate both mechanical and chemical changes and the enzymes which take part.

REVIEW QUESTIONS

1. Define the following terms: digestion, enzyme, villus, lacteal, peristalsis, digestibility.

2. List five characteristics of enzymes.

3. Name the important digestive enzymes, tell what nutrient each acts upon, and what reaction is favorable for its action.

4. Why are fried meats retained in the stomach longer than broiled meats?

5. What factors affect the stomach emptying time?

6. What is the purpose of saliva?
7. What are the functions of hydrochloric acid?
8. What happens to each of the nutrients after absorption?
9. What function does the large intestine serve?

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CHAPTER XI

Planning Diets for Adequacy and Economy

Preceding chapters have emphasized the importance of adequate intake of the various food constituents in order to maintain good nutrition and health. The next problem then is the proper correlation of this information for the planning of satisfactory daily dietaries. It must be realized however that meal planning does not consist in a mere counting of calories or of the number of grams of protein. It is not nearly as dull as that! While it is impossible to obtain a good state of nutrition without the daily inclusion of the necessary nutrients, it is equally impractical to consider feeding from the standpoint of food essentials alone. Such factors as digestibility, palatability, economy, and family customs relating to religion and nationality determine whether or not the food can be actually supplied and utilized. The subject of adequacy and economy will be considered here. Problems relating to national and religious food customs are discussed in Chapter XII while the details of meal planning are covered in Chapter L.

ADEQUACY OF THE DIET

Recommended Allowances. Meal planning for a family group may become fairly complex unless one adheres to certain basic rules. The size, age, temperament, and activity of each member of the family must be considered. A tense, active, underweight youngster needs additional food allowances while another placid, less energetic individual needs a smaller food intake. A man doing heavy outdoor labor needs more of the energy foods to carry him through the day than the office worker whose activities are much less.

In May 1941 the Food and Nutrition Board of the National Research Council adopted a "yardstick" of food needs for people of different ages and activities. It became apparent as time went on that a revision of this table, especially with respect to the B

vitamins, was indicated. After careful consideration of the evidence, the revisions were adopted in June 1945. The new table of "Recommended Allowances" is given on pages 128-9. In using these recommendations it is important that the committee's purpose and general policies in formulating them should be understood. These policies are quoted in part here.

"Experimental evidence for human requirements is far from adequate, especially for vitamin A and the B group of vitamins. Even though the requirement is fairly well established for a number of essentials for certain age groups or conditions, rarely is information available from a complete series of studies, especially throughout the growth period. Data concerning the period of adolescence are conspicuously lacking. Thus it became necessary to formulate many of the allowances in part on the basis of the judgment of nutrition workers whose experiences permitted decisions as to the values to interpolate for those that were lacking. Undoubtedly, continued research will make further revision of the allowances necessary.

"The allowances for adults are given for a man of 70 kg. and a woman of 56 kg. They should be decreased proportionately for smaller or larger persons and for different levels of activity. The allowances for children are given for age groups, and for boys and girls separately after 12 years because from that age the growth curves and levels of activity differ. The values stated are for the middle age of the group and for children of average size and activity.

"The allowances are for persons in health. Needs vary greatly in disease. For example, in febrile conditions an increased need usually exists for calories, thiamine, and ascorbic acid. The need for these and other constituents may be greatly altered also in other diseases, especially those of the alimentary tract which interfere with absorption.

"The values of the table are for content of foods as eaten and do not allow for losses in storage, cooking, and serving. Because such losses, especially of the water-soluble vitamins, may be extensive, provision should be made for them in planning practical dietaries.

"The allowances are intended to serve as a guide for planning an adequate diet for every normal person of the population and not

	Calories	Protein grams	Calcium grams
Man (154 lb., 70 kg.)			
Sedentary	2500	70	0.8
Moderately active	3000	70	0.8
Very active	4500	70	0.8
Woman (123 lb., 56 kg.)			
Sedentary	2100	60	0.8
Moderately active	2500	60	0.8
Very active	3000	60	0.8
Pregnancy (latter half)	2500 ###	85	1.5
Lactation	3000	100	2.0
Children up to 12 yrs. †:			
Under 1 yr. ††	100/2.2 lb.	3.5/2.2 lb. (1 kg.)	1.0
1 - 3 yrs. (29 lb., 13 kg.)	1200	40	1.0
4 - 6 yrs. (42 lb., 19 kg.)	1600	50	1.0
7 - 9 yrs. (55 lb., 25 kg.)	2000	60	1.0
10 - 12 yrs. (75 lb., 34 kg.)	2500	70	1.2
Children over 12 yrs. †:			
Girls, 13 - 15 yrs. (108 lb., 49 kg.)	2600	80	1.3
16 - 20 yrs. (119 lb., 54 kg.)	2400	75	1.0
Boys, 13 - 15 yrs. (103 lb., 47 kg.)	3200	85	1.4
16 - 20 yrs. (141 lb., 64 kg.)	3800	100	1.4

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* Tentative goal toward which to aim in planning practical dietaries; can be met by a good diet with a variety of natural foods. Such a diet will also provide other minerals and vitamins, the requirements for which are less well known.

** The allowance depends on the relative amounts of vitamin A and carotene. The allowances of the table are based on the premise that approximately two thirds of the vitamin A value of the average diet in this country is contributed by carotene and that carotene has half or less than half the value of vitamin A.

*** For adults (except pregnant and lactating women) on diets supplying 2,000 calories or less, such as reducing diets, the allowances of thiamine, riboflavin, and niacin may be 1 mg., 1.5 mg. and 10 mg. respectively. The fact that figures are given for different calorie levels for thiamine, riboflavin, and niacin, does not imply that we can estimate the requirement of these factors within 500 calories, but they are added merely for simplicity of calculation. Other members of the B complex also are required, though no values can be given. Foods supplying ade-

ALLOWANCES REVISED, 1945 *

Research Council, Washington, D. C.

Iron mg.	Vitamin A ** I. U.	Thiamine mg.***	Ribo-flavin mg. ***	Niacin (Nicotin-ic Acid) mg. ***	Ascorbic Acid mg.	Vitamin D I. U.
12 #	5000	1.2	1.6	12	75	##
12 #	5000	1.5	2.0	15	75	##
12 #	5000	2.0	2.6	20	75	##
12	5000	1.1	1.5	11	70	##
12	5000	1.2	1.6	12	70	##
12	5000	1.5	2.0	15	70	##
15	6000	1.8	2.5	18	100	400 to 800
15	8000	2.0	3.0	20	150	400 to 800
6	1500	0.4	0.6	4	30	400 to 800
7	2000	0.6	0.9	6	35	400
8	2500	0.8	1.2	8	50	400
10	3500	1.0	1.5	10	60	400
12	4500	1.2	1.8	12	75	400
15	5000	1.3	2.0	13	80	400
15	5000	1.2	1.8	12	80	400
15	5000	1.5	2.0	15	90	400
15	6000	1.8	2.5	18	100	400

quate thiamine, riboflavin, and niacin will tend to supply sufficient of the remaining B vitamins.

There is evidence that the male adult needs little or no iron. The requirement will be provided if the diet is satisfactory in other respects.

For persons who have no opportunity for exposure to clear sunshine and for elderly persons, the ingestion of small amounts of vitamin D may be desirable. Other adults probably have little need for vitamin D.

During the latter part of pregnancy the allowance should increase approximately 20 percent over the preceding level. The value of 2500 calories represents the allowance for pregnant, sedentary women.

† Allowances for children are based on the needs for the middle year in each group (as 2, 5, 8, etc.) and are for moderate activity and for average weight at the middle year of the age group.

†† Needs of infants increase from month to month with size and activity. The amounts given are for approximately 6 to 8 months. The dietary requirements for some of the nutrients such as protein and calcium are less if derived largely from human milk.

for the average member of the group categories. Experience has shown that the biological normal consists of a range of values. In order to meet the needs of the whole population it is necessary to satisfy the requirements of those with less efficient usage. Because the allowances take into consideration the requirements of those at the upper level of the normal range of requirement, they allow a factor of safety for persons who have an average or less than average requirement. In most categories this factor of safety is approximately 30 per cent, but for many normal persons the allowances cover only the amounts needed for maintenance. Insomuch as many persons who receive less than the recommended allowance of one or another nutrient may remain in excellent health through long periods, it becomes apparent that these allowances are not to be used as the sole criterion for judging the state of nutrition of any population.

"In addition to meeting the immediate needs of normal persons with relatively low efficiency, the allowances are expected to cover for the average person any differences that might exist between short-time need and that for the life span, though information is lacking that would permit stating with accuracy the amounts of the various nutrients more suitable for the whole life span. Studies with animals have indicated that amounts of some nutrients sufficient to provide health for short portions of the life span may be inadequate to maintain good health for the life span as a whole.

"In using the recommended allowances it is to be emphasized that the amounts of the various nutrients, with the exception of vitamin D, can be obtained through a good diet of natural foods. Flour should be whole grain or enriched. Excessive use of vitamin-poor foods should be avoided and loss and waste in preparation and serving should be minimized.

"It is fortunate that optimum nutrition can be provided by an unlimited number of combinations of foods. It is expected that nutrition workers will translate the allowances into appropriate quantities of foodstuffs available in their own localities and suited to the income level of the group concerned. The allowances expressed in terms of everyday local foods, can be used widely in nutrition work." [1]

Basic Food Groups. The average homemaker has neither the time nor the available information to use the figures in the yardstick as they stand, so it becomes necessary to translate them in terms of food which must be used if these standards are to be met. Foods from each of these "basic 7" groups should be included daily.

BASIC 7 FOODS

	SUGGESTED AMOUNTS
Group 1—Green and yellow vegetables—some raw, some cooked, frozen, or canned	1 serving
Group 2—Citrus fruits and tomatoes, raw cabbage, or salad greens	1 serving
Group 3—Potatoes, other vegetables, and fruit	3 servings
Group 4—Milk and milk products. Fluid, evaporated, and dried milk, or cheese	1 pint milk or equivalent for adults 1 quart milk for every child
Group 5—Meat, poultry, fish, or eggs, or dried beans, peas, nuts, or peanut butter	2 servings
Group 6—Cereals, natural, whole grain, enriched, or restored	2 servings
Group 7—Butter or fortified margarine	1 tablespoon

The table on page 132 indicates the contributions which these foods in the amounts stated would make in the daily diet of an adult. It will be noted that some of the factors are below the recommended allowances. However, in order to obtain sufficient calories a variety of foods will be used as one desires, and they will each supply protein, minerals, and vitamins depending upon the type of food which is chosen. The needs are usually easily satisfied if the individual follows Dr. McCollum's dictum: Eat what you want after you have eaten what you should! A consistent maintenance of normal weight in the adult, or a normal rate of gain in the child, is the best indication that energy intake is adequate. Cereals, sugars, starches, and fats are important energy foods.

Additional protein may be obtained by including another egg, some cheese, or legumes, an extra glass of milk, or by increasing the size of the portion of meat. Reduction in size of portions of these foods will proportionately reduce the protein intake.

FOOD VALUE OF THE BASIC SEVEN FOODS*

Food	Amount	Protein Gm.	Calcium Gm.	Iron mg.	Vitamin A I. U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	Calories
Green and yellow vegetables	1 serving	2	.05	1.5	5,140	.09	.12	.06	39	45
Citrus fruits, tomato, or cabbage	1 serving	1	.02	.4	380	.05	.03	.36	30	34
Potato, white	1 medium	2	.01	.7	40	.11	.04	1.21	12	85
Other fruits and vegetables	2 servings	3	.04	1.2	400	.10	.10	.80	35	130
Milk	1 pint	16	.54	.9	765	.18	.81	.50	5	310
Meat, fish, or fowl	3 ounces	17	.02	2.3	1,800	.31	.36	6.30		200
Egg	1	7	.03	1.4	495	.07	.19	.03		80
Whole-grain or enriched cereal	1 serving	2	.01	.7		.08	.03	.77		75
Whole-grain bread	1 slice	3	.02	.8		.09	.04	1.06		75
Butter	½ ounce				480					110
		53	.74	9.9	9,500	1.08	1.72	11.09	121	1,144

* The values are based on averages of foods which are representative of selections made from day to day. For example, the figures for meat include 14 cuts of meat, fish, or fowl; those on green or yellow vegetables are based on 10 vegetables; the average for other fruits and vegetables is based on 17 foods.

Allowance has not been made for losses in cooking; hence the values for vitamin C especially may appear to be high.

Meal Patterns. The basic foods together with additional foods for energy may be arranged in menus as follows:

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Stewed apricots
Whole-grain cereal	Oatmeal with cream
Milk or cream for cereal	
Eggs and bacon, if desired	Scrambled eggs with bacon
Whole-grain or enriched bread	Wholewheat toast with butter
Butter or fortified margarine	
Beverage (milk for children)	Coffee; cocoa for children
Luncheon or supper	
Egg, cheese, legumes, meat, or fish	Macaroni and cheese
Starchy food as potato, macaroni	
Vegetable, cooked or raw	Buttered peas
Whole-grain or enriched bread	Rye bread with fortified oleomargarine
Butter or fortified margarine	
Fruit	Orange and apple salad with French dressing
Milk	Milk
Dinner	
Meat, fish, or poultry	Roast beef with gravy
Potato	Mashed potatoes
Vegetable, yellow or green	Buttered green beans
Bread with butter or margarine	Hot biscuits with butter
Dessert	Tapioca pudding
Beverage (milk for children)	Tea; milk

ECONOMY

Cost of Food in Relation to Income. On a liberal income the money spent for food will represent a relatively small proportion of the total money spent even though a wide variety of luxury foods may be included. However, as the income of the family unit decreases it becomes necessary to increase the proportion spent for food even though the choice may be quite limited. As much as 50 to 60 per cent, and sometimes more, of the money spent by low income groups must be allocated to food purchases. Obviously for these groups which are in the majority it is imperative that one

know the factors of economy in order that the food dollar will be so wisely spent that adequate diets are made possible.

Selection of Food at Various Income Levels. Can a diet be adequate and still come within the reach of those living upon a low income level? The answer to this question depends upon the proper distribution of money expenditures to insure optimum nutrition and palatability. Sherman[2] cites the following plan for the wise spending of the food dollar:

> "One-fifth, more or less, for vegetables and fruit;
> One-fifth, or more, for milk and cheese;
> One-fifth, or less, for meat, fish, and eggs;
> One-fifth, or more, for bread and cereals;
> One-fifth, or less, for fats, sugar and other groceries
> and food adjuncts

"Whatever the level of expenditure, it seems wise to observe the two suggestions that: (1) at least as much should be spent for milk (including cream and cheese if used) as for meat, poultry and fish; and (2) at least as much should be spent for fruits and vegetables as for meats, poultry and fish."

As smaller amounts of money become available for food it becomes increasingly important to emphasize the basic 7 foods. Bread and milk justly form the fundamental dietary for families on low income groups. Milk is a food par excellence and should not be restricted below the amounts necessary for adequate nutrition since no other food supplies so many nutrients at so low a cost. The cereals, including bread, crackers, macaroni, rice, noodles, spaghetti, will be consumed in large amounts since they comprise the cheapest source of energy foods. While their proteins are incomplete, the contribution which cereals make in this respect is valuable when they are supplemented with milk. Mineral and vitamin additions will also be made if at least half of the cereals used are whole grain products. Up to 40 per cent of the necessary calories in a low cost diet will be derived from this group of foods, whereas only 20 per cent of the required calories in a high cost diet will need to come from these inexpensive sources of energy.

Meat consumption should be kept at a minimum for low cost meals. Diets may be entirely adequate without meat if eggs, milk, and cheese are freely used; however, few foods possess the satiety

value of meat. Small quantities of inexpensive cuts may be used, especially if dishes such as stews and meat pies are skillfully prepared to extend the flavor of meat.

As the income allows more money to be spent for food it is generally found that vegetables, fruits, meats, and eggs will be used in more liberal quantities. Packaged goods and highest grades of food will also be purchased more freely.

The lists on pages 136-8 show different types of food arranged in three levels of cost.

Some Ways of Effecting Economy. These suggestions have been found to be valuable in practicing economy:

1. Plan menus for several days at the time to meet the nutritional needs of the family. These menus should be sufficiently flexible so that advantage can be taken of sales and left-over foods.

2. Select the most economical method of marketing. This will be for most homemakers the cash-and-carry system where one makes personal selection. The overhead expense of delivery and bad debts is thus eliminated for the retailer.

3. Know what constitutes a good purchase. A knowledge of cuts of meat, for example, will help to determine when a cheap cut is a wise selection and when the waste is so great that it becomes false economy. Wilted vegetables may be poor economy because of the great loss of vitamins which has probably occurred in them.

4. Be familiar with the grades and brands of foods, and know what grades can be used for the meal in question. For example, broken pieces of canned fruit may be just as satisfactory in fruit salad as the more expensive perfect whole fruits. The less highly advertised product is often as good as one with a well known brand name.

5. Buy foods which are in season and in abundance on the market since their cost should be less.

6. Buy foods in bulk if they are sold under sanitary conditions since they are less expensive than boxed products.

7. Buy foods in quantities if there is adequate storage space and if the food can be used without waste through spoilage.

8. Compare weights and prices of packaged and canned goods.

9. Buy less expensive forms of food whenever possible. Oleomargarine fortified with vitamin A is a good substitute for butter.

FOOD LISTED ACCORDING TO COST

Type of Food	Low Cost	Moderate Cost	Liberal to Expensive
Cereal grains and their products	Corn meal Hominy—grits or "lye" hominy	Fancy rice, white or brown	
Flours	Cornstarch White flour	White flours, graham flour	Arrowroot, barley, rice, potato, banana, highly refined cake flours (boxed)
Breakfast foods	Oatmeal, especially in bulk Rice in bulk	Corn, rice and wheat flakes; All-Bran, Cream of Wheat, Ralston's, Super Farina, Wheatena, Shredded Wheat, etc. Strained cereals for infants*	
Bread	Day-old bread Soda crackers in bulk	Raisin and nut bread Waffles and griddle cakes Boxed crackers of all kinds	Fancy rolls Sweet crackers Imported crackers
Other starches	Macaroni in bulk Spaghetti in bulk Noodles in bulk	Boxed macaroni, spaghetti, noodles	Imported pastes, such as egg noodles, etc.
Sugars and sweets	Granulated sugar Beet sugar Molasses Corn syrup Sorghum	Sugar: cubes, blocks, powdered Brown sugar Maple sugar Honey New Orleans molasses (in cans) Maple syrup Refined corn syrup Jellies and preserves Candies	Fancy-colored sugar Fine confections Imported candies, crystallized fruits, orange and lemon peel Imported jellies and jams
Fats	Margarines Cottonseed oil, suet, drippings, salt pork (at some seasons)	Butter, butter substitutes Lard and lard substitutes Wesson, corn, peanut oil	Heavy cream, 32 to 40 per cent Desserts made from heavy cream Fine imported olive oil

*There are several good brands of cooked and reinforced cereals for use in infant-feeding.

	Meat skins	Salt pork and bacon Olive oil (some grades)	Fish preserved in oils (generally imported) Fancy sliced and Canadian bacon
Fruits Fresh	Apples (native, in season) Bananas (medium to small) Strawberries or other berries in season (native) Watermelon in season	Apples, bananas, pears, plums, peaches, grapes, berries (in season), cherries (if native), fresh pineapple, grapefruit, oranges (small to medium), rhubarb, figs (if native, in season), raspberries, blueberries, blackberries, dewberries, Youngberries (in season)	Large oranges, tangerines, nectarines, apricots, fancy grapefruit, pears, grapes, etc., if imported Most berries out of season Fancy melons: casaba, honeydew, Christmas, Persian
Canned	Some brands of sliced peaches, pineapple, pears (water packed, not standard)	Standard brands of most fruits and fruit juices Apricots and prunes Water-packed (no sugar) Juice-packed (sugar syrup)	Fancy brands, extra-large fruits Preserves and pickles Applesauce Fancy prunes
Dried	Apples, peaches, prunes (small)	Evaporated apples, peaches, pears, apricots, raisins, dates, currants, figs, medium-size prunes	Large fancy prunes Stuffed prunes, dates, and figs Crystallized fruits and peels Citron Large whole figs
Vegetables* Fresh	Cabbage, greens — beet, dandelion, mustard, turnip Garden lettuce Carrots, turnips, beets; potatoes — sweet, white; string beans in season, field peas and beans, onions, old or green in season	Asparagus in season Cauliflower, green corn (in season), celery, cucumbers, squash, spinach, eggplant, tomatoes, string beans, sauerkraut, green peppers, okra, parsnips, salsify, new potatoes, artichokes in season	Vegetables out of season Brussels sprouts Artichokes out of season
Canned	Tomatoes, sauerkraut (some local brands, not standard)	Most vegetables in standard brands Soups, baked beans, succotash	Most vegetables in fancy brands and selected specimens such as giant asparagus, tiny peas, baby Limas, etc.
Dried	Beans, peas, and lentils		

*There are several excellent brands of strained vegetables on the market for infant-feeding.

FOOD LISTED ACCORDING TO COST (*Continued*)

Type of Food	Low Cost	Moderate Cost	Liberal to Expensive
Eggs and dishes made of eggs	Storage eggs at times Custards when eggs are cheap, also fruit whips	Fresh eggs Day-old eggs at certain seasons Custards, frozen and plain Sponge, Angel Food cakes	At some seasons
Milk	Buttermilk Skimmed milk Whole milk in bulk Irradiated evaporated milk	Grade A milk Acidophilus milk Bulgarian buttermilk Malted milk	Especially prepared milk for infants Certified milk Milk from cows fed irradiated food
Cheese	Some local cheeses	American cream cheese Domestic cheese in jars or boxed	Imported: Roquefort, Brie, Camembert, Swiss, etc.
Meat, fish, and poultry	Flank steak** Neck bones Meat skins Ham hocks Hamburger Stew meat	Round steak, brisket Lamb shoulder Veal chops Ground beef Pork sausage, chops, liver Pot roast Porterhouse steak (when price of all meat is not extremely high)	Tenderloin and sirloin steaks, prime roast of beef Crown roast of lamb Calves' liver, sweetbreads Lamb chops Filet mignon
		Fowl	Spring broilers and fryers Duck (domestic and wild) Turkeys Guinea fowl Pheasant, grouse, quail
		Native fish in season Canned fish: tuna, salmon, mackerel, domestic sardines, shrimp	Canned imported sardines Pate de fois gras Caviar

**Flank steak requires long cooking to be tender. If fuel is expensive, this is not cheap meat.

Lard, suet, and vegetable oils are less expensive than hydrogenated fats and olive oil. Bread is more economical than fancy rolls. Color and grade of eggs do not affect their food value. In some vicinities canned milk is more economical than fresh milk.

10. Store foods properly after their purchase to avoid loss of vitamin values or spoilage.

11. For family groups prepare foods in the home since that is not only more economical but may also produce a better tasting and more nutritious product. This is particularly true for the type of foods frequently bought in bakeries and delicatessen stores, such as pastries, puddings, salads, prepared meats.

The outlines of good diets at 3 levels of cost (pages 140-3), planned by the United States Bureau of Home Economics[3] suggest wise expenditure of money.

SUMMARY

1. Satisfactory meal planning requires consideration of nutritional adequacy, digestibility, palatability, economy, and family religious and social customs.

2. Adequacy of the diet is most easily assured if each of the basic 7 food groups are included in the daily diet.

3. Calcium, phosphorus, and iron are the minerals most commonly deficient in the daily diet. The first two needs are easily met if the diet always includes a quart of milk for the child and pregnant woman and a pint of milk for the adult. The iron requirements will be met through the use of fruits, vegetables, whole-grain cereals, and eggs.

4. Thiamine, riboflavin, ascorbic acid, and vitamin A also require special emphasis. In addition to the foods listed above it is imperative that butter or fortified oleomargarine be supplied daily for vitamin A and that citrus fruits, tomato, or raw cabbage be incorporated for ascorbic acid.

5. Maintenance of normal weight in the adult and a desirable rate of growth in the child are good criteria that the energy intake is adequate.

6. Milk and cereals are important foods in low cost diets. As the income decreases the consumption of cereals will increase.

7. Meats should be strictly limited on low income diets.

(Continued on page 144.)

THREE GOOD DIETS AT

Prepared by the U. S. Bureau

KINDS AND AMOUNTS OF

Persons	Milk[1]	Potatoes, Sweet-Potatoes		Tomatoes, Citrus Fruit		Leafy, Green, Yellow Vegetables		Dried Beans, Peas, or Nuts	
	Quarts	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
This Is an Expensive									
Children under 2 years	5	1	0	1	8	1	8	0	0
Children 2–3 years	7	1	8	1	8	2	8	0	0
Boys:									
4 to 6 years	7	1	12	1	8	2	8	0	0
7 to 8 years	7	2	0	1	12	3	8	0	1
9 to 10 years	7	2	0	2	0	3	12	0	1
11 to 12 years	7	2	4	2	4	3	12	0	1
13 to 15 years	7	3	0	2	8	3	8	0	2
16 to 19 years	7	4	4	2	8	3	8	0	2
Girls:									
4 to 7 years	7	1	12	1	8	2	8	0	0
8 to 10 years	7	2	0	1	12	3	8	0	1
11 to 13 years	7	2	0	2	0	3	12	0	1
14 to 19 years	7	2	4	2	4	3	12	0	1
Men 20 years and over:									
Active work	3½	5	12	2	8	3	8	0	2
Moderate work	3½	3	0	2	8	3	8	0	2
Inactive	5	2	4	2	4	3	12	0	1
Women 20 years and over:									
Active work	3½	3	0	2	8	4	0	0	1
Moderate work	3½	2	4	2	4	4	0	0	1
Inactive	5	1	8	2	4	3	12	0	1
This Is a Moderate-									
Children under 2 years	5	1	0	1	8	1	8	0	0
Children 2–3 years	7	1	12	1	8	2	8	0	0
Boys:									
4 to 6 years	7	2	0	1	8	2	8	0	1
7 to 8 years	7	2	0	1	8	3	8	0	2
9 to 10 years	7	2	4	1	12	3	12	0	2
11 to 12 years	7	2	8	1	12	3	12	0	2
13 to 15 years	7	3	0	2	0	3	0	0	4
16 to 19 years	7	4	4	2	0	3	0	0	4
Girls:									
4 to 7 years	7	2	0	1	8	2	8	0	1
8 to 10 years	7	2	0	1	8	3	8	0	2
11 to 13 years	7	2	4	1	12	3	12	0	2
14 to 19 years	7	2	8	1	12	3	12	0	2

[1] Or its equivalent in cheese, evaporated or dried milk.

[2] Count fatty bacon and fat back as fat, not as meat.

THREE LEVELS OF COST
of Home Economics[3]
FOODS FOR A WEEK

Dried Fruit		Other Vegetables, Fruits		Eggs	Lean Meat, Poultry, Fish[2]		Flour, Bread,[3] Cereals		Sugars[4]		Butter		Other Fats	
Lbs.	*Oz.*	*Lbs.*	*Oz.*	*Number*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
Good Diet														
0	0	0	0	4	0	0	0	12	0	1	0	2	0	0
0	1	2	8	6	0	6	1	0	0	2	0	3	0	0
0	1	4	0	7	0	12	1	4	0	4	0	4	0	1
0	2	5	0	7	1	12	1	8	0	8	0	8	0	1
0	2	5	12	7	2	8	1	8	0	12	0	12	0	1
0	3	6	0	7	3	0	1	8	0	12	0	12	0	1
0	3	7	0	7	3	12	2	0	1	0	0	12	0	3
0	3	8	0	7	4	12	2	8	1	8	0	12	0	12
0	1	4	0	7	0	12	1	4	0	4	0	4	0	1
0	2	5	0	7	1	12	1	8	0	8	0	8	0	1
0	2	5	12	7	2	8	1	8	0	12	0	12	0	1
0	3	6	0	7	3	0	1	8	0	12	0	12	0	1
0	2	8	0	7	4	12	4	8	2	0	0	12	1	2
0	2	7	0	7	4	0	2	4	1	4	0	12	0	8
0	2	5	8	7	2	8	1	12	0	12	0	12	0	1
0	2	7	0	7	3	12	2	4	1	4	0	12	0	8
0	2	6	0	7	3	0	1	12	1	0	0	12	0	3
0	2	5	8	7	2	8	1	4	0	12	0	12	0	1
Cost Good Diet														
0	0	0	0	4	0	0	0	12	0	1	0	2	0	0
0	1	1	12	6	0	6	1	4	0	2	0	3	0	0
0	2	2	0	7	0	12	1	8	0	4	0	4	0	1
0	3	2	8	7	1	8	2	0	0	8	0	8	0	1
0	4	3	4	7	2	0	2	8	0	12	0	8	0	4
0	4	4	0	6	2	8	2	8	0	12	0	8	0	4
0	5	5	8	6	2	12	3	4	1	0	0	8	0	8
0	6	6	0	5	3	0	3	12	1	8	0	8	1	1
0	2	2	0	7	0	12	1	8	0	4	0	4	0	1
0	3	2	8	7	1	8	2	0	0	8	0	8	0	1
0	4	3	4	7	2	0	2	8	0	12	0	8	0	4
0	4	4	0	6	2	8	2	8	0	12	0	8	0	4

[3] Count one and one-half pounds of bread as one pound of flour.
[4] Include white, brown, or maple sugars, syrups, molasses, jellies, preserves, candies, etc.

THREE GOOD DIETS AT THREE

Prepared by the U. S. Bureau

KINDS AND AMOUNTS OF

Persons	Milk[1]	Potatoes, Sweet Potatoes		Tomatoes, Citrus Fruit		Leafy, Green, Yellow Vegetables		Dried Beans, Peas, or Nuts	
	Quarts	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
						THIS IS A MODERATE-			
Men 20 years and over:									
Active work	3½	5	12	2	0	3	0	0	4
Moderate work	3½	3	0	2	0	3	0	0	3
Inactive	5	2	8	1	12	3	8	0	2
Women 20 years and over:									
Active work	3½	3	0	2	0	4	0	0	4
Moderate work	3½	2	8	1	12	4	0	0	2
Inactive	5	1	12	1	12	3	8	0	2
						THIS IS A LOW-			
Children under 2 years	5	1	8	1	4	1	8	0	0
Children 2–3 years	7	1	12	1	4	2	8	0	0
Boys:									
4 to 6 years	7	2	0	1	4	2	8	0	2
7 to 8 years	5–7	2	4	1	4	3	8	0	3
9 to 10 years	5–7	2	8	1	4	3	12	0	3
11 to 12 years	5–7	2	12	1	4	3	12	0	4
13 to 15 years	5–7	3	0	1	4	3	0	0	4
16 to 19 years	5–7	4	4	1	4	3	0	0	4
Girls:									
4 to 7 years	7	2	0	1	4	2	8	0	2
8 to 10 years	5–7	2	4	1	4	3	8	0	3
11 to 13 years	5–7	2	8	1	4	3	12	0	3
14 to 19 years	5–7	2	12	1	4	3	12	0	4
Men 20 years and over:									
Active work	3½	5	12	1	4	3	0	0	8
Moderate work	3½	3	0	1	4	3	0	0	6
Inactive	3½–5	2	12	1	4	3	8	0	3
Women 20 years and over:									
Active work	3½	3	0	1	4	3	8	0	4
Moderate work	3½	2	12	1	4	3	8	0	4
Inactive	3½–5	2	0	1	4	3	8	0	3

[1] Or its equivalent in cheese, evaporated or dried milk.

[2] Count fatty bacon and fat back as fat, not as meat.

Dried Fruit		Other Vege-tables, Fruits		Eggs	Lean Meat, Poultry, Fish[2]		Flour, Bread,[3] Cereals		Sugars[4]		Butter		Other Fats	
Lbs.	*Oz.*	*Lbs.*	*Oz.*	*Number*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
Cost Good Diet (*Continued*)														
0	6	5	8	5	3	12	5	12	2	0	0	8	1	7
0	4	5	0	5	3	0	3	8	1	4	0	8	0	12
0	3	3	0	6	2	8	2	4	0	12	0	8	0	4
0	4	5	12	6	3	0	3	4	1	4	0	8	0	12
0	4	4	0	6	2	8	2	12	1	0	0	8	0	8
0	3	3	0	6	2	8	1	8	0	12	0	8	0	4
Cost Good Diet														
0	0	0	0	4	0	0	1	0	0	1	0	2	0	0
0	1	0	8	5	0	4	1	8	0	2	0	3	0	0
0	2	1	0	5	0	8	2	0	0	4	0	4	0	1
0	2	1	8	5	1	4	2	12	0	8	0	6	0	1
0	3	2	0	4	1	8	3	0	0	12	0	6	0	6
0	3	2	0	4	1	12	3	8	0	12	0	6	0	6
0	4	2	8	4	2	0	4	8	1	0	0	6	0	10
0	4	2	8	3	2	12	6	0	1	4	0	6	0	12
0	2	1	0	5	0	8	2	0	0	4	0	4	0	1
0	2	1	8	5	1	4	2	12	0	8	0	6	0	1
0	3	2	0	4	1	8	3	0	0	12	0	6	0	6
0	3	2	0	4	1	12	3	8	0	12	0	6	0	6
0	4	2	8	3	3	0	8	0	1	8	0	6	1	2
0	4	2	8	3	2	8	4	8	1	4	0	6	0	10
0	3	2	0	4	1	12	3	0	0	12	0	6	0	6
0	4	2	8	4	2	0	4	8	1	4	0	6	0	10
0	4	2	8	4	1	12	3	8	1	0	0	6	0	6
0	3	2	0	4	1	12	2	4	0	12	0	6	0	6

[3] Count one and one-half pounds of bread as one pound of flour.
[4] Include white, brown, or maple sugars, syrups, molasses, jellies, preserves, candies, etc.

8. Careful planning and knowledge of factors in marketing result in worth-while economies.

PROJECTS

This family group may be used for one or more of the following projects:

Father: 25 pounds underweight; works in a factory; carries lunch to work
Mother: pregnant (seventh month)
Boy: 14 years; in school; very active
Boy: 10 years; in school
Girl: 3 years

All children come home from school at noon for lunch

1. Tabulate the daily nutritional requirements of each member of the family by referring to the yardstick.
2. Plan adequate low cost menus for one day for the family. Indicate in table form the amounts of food each individual should consume daily to meet nutritional requirements.
3. Plan the amounts of milk, cheese, eggs, and meat needed in one week to meet $\frac{2}{3}$ of the needs of the above family for protein.

REVIEW QUESTIONS

1. What is meant by the basic 7 food groups? What foods are included in each group? What nutrients does each group supply?
2. What changes would you make in the daily dietary of a young child? an adolescent boy? a lactating woman? an underweight man?
3. What is the influence of activity and climate on food requirements?
4. Why should the three meals for the day be planned as a unit rather than separately?
5. Give one good rule for the distribution of food costs.
6. If the income is limited what foods would be used in large amounts? in small amounts?
7. Name 10 ways in which economy can be effected in meal planning and marketing.
8. Why is a study of food costs important to the nurse?

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CHAPTER XII

Feeding the Foreign Born

The United States numbers many foreign-born people among her population. The majority of these people settle in or near the large cities and must, at one time or another, come to the hospital, dispensary, food clinic, or social agency for treatment or advice. Many of these foreigners are unaccustomed to city life and find it doubly hard to fit into the new scheme of things. Not to be able to understand or speak the language spoken around one is sufficiently discouraging, without the added burden of having to change completely the food habits and customs which have been passed down to one through countless generations.

Among the most interesting problems with which a nurse or other health worker comes in contact are those relating to the understanding and care of people born in other countries or descended from foreign-born parents. To attempt to work with any such individual or group without some intelligent comprehension of the racial background is likely to invite failure. Such lack of comprehension may sow a seed of misunderstanding and distrust of American life and is likely to militate against the adjustment of the foreign-born to life in America. On the other hand, an understanding of and acquaintance with the background — the holidays, heroes, customs, religion, and food habits — of these people will establish an immediate bond of sympathy and cooperation which is absolutely vital to a successful relationship.

The purpose of this chapter is to give the nurse some definite knowledge and insight into the lives and customs of her patients, many of whom are carrying on the dietary habits and customs which were old long before America was discovered.

The growth and development of any race are dependent upon and molded by its physical environment. A moment's thought will serve to awaken one to the vital role which topography and geog-

raphy necessarily play in the type and amount of food raised. For instance, southern Italy, with its subtropical climate and rich farming lands, supplies a quantity of fruits, green vegetables, and wheat, while the colder countries of central Europe produce hardier grains, such as rye and barley, and root, rather than green vegetables. The great range of the United States convincingly demonstrates the tremendous variations in the types of foods grown and used according to geographical and climatic conditions. Foods vary from the wheat of the northern Middle West to the rice of Louisiana, from the potatoes of Maine to the citrus fruits of Florida, and from the dairy products of Minnesota, Iowa, and Wisconsin to the apples of New York and Washington.

The progress of civilization, economic conditions, and the degree of mechanical advancement of any country, as well as climate and physical environment, determine facilities for the preservation and transportation of foods. These facilities, in turn, markedly influence not only the types of food used but also the method of preparation. For instance, in Syria and Armenia, where trains are little known and transportation is mostly by camel, each group raises its own food supply for the year and is not dependent upon food from outside sources. The raw sheep's milk is stored in bags or containers made of the stomachs of sheep, and it quickly sours. In Italy, goat's milk is preserved in the form of cheese, and pasteurized milk in bottles is unheard of.

But there are other equally important influences which must not be ignored. These are the influences of a social and religious nature. For instance, the religious laws of the Jews place restrictions upon certain foods, prohibit the use of others, and dictate the methods of preparation. In learning about these laws, one acquires many historical and social facts which are not only interesting but of great value in working successfully with orthodox Jewish patients.

By far the largest proportion of foreign-born people in the United States have come from the peasant or land-working classes, although some lived in cities where poverty was indescribable. The rural immigrants are, as a rule, healthy, the fittest of a hardy race, imbued with courage, a desire to get ahead, and a willingness to sacrifice for that goal. In most cases an instinct for survival has led people, in their own countries, to select a diet of simple foods which

has built the foundations of rugged health, though variety may have been lacking and refinement of food unknown. Adjustment, hard at best, is often complicated by the unnatural environment of city life, poverty, and unfamiliar work, which eventually result in many serious problems.

One must remember that there can be no growth and development of any race without certain basic food constituents — protein, carbohydrate, fat, minerals, vitamins, and water. Fooa the world over supplies these constituents; or if some element is omitted, Nature compensates in the physical environment. For instance, in Italy the sunshine supplies enough ultraviolet light to make the calcium in the food completely available to the body, although, according to our standards, the supply of calcium may be low. The Eskimos eat the internal organs and the blood of the animals, getting therefrom a rich supply of Vitamin D to compensate for the lack of sunshine. The physical development of any race depends largely upon the available supply of these basic constituents. The nurse must understand that these basic elements are the same, whether the food that supplies them is grown in America or any other land. With such an understanding she will not, through lack of knowledge, try to superimpose American ways on a foreign people but will endeavor to bring the better features of the native diet, which are easily available in the United States, into harmonious adjustment with those changes which a new environment makes necessary if health is to be maintained. The use of milk must be stressed.

In dealing with people of foreign birth or descent, it is well to remember that because of natural taste and tradition they desire their own foods, which are often more costly because of the expense of importation. Many of them have special holidays which are celebrated with special foods; and to deprive them of the foods which have formed the basis of their diets or which play important roles in religious or social customs is often an expensive procedure, resulting in maladjustments, resentment, and even sickness. Adjustment to American ways comes slowly and through many channels. The influence of children going to school and mingling with American-born youngsters is of great importance, and through their desire to be like others a change in the family food habits gradually takes

place. Here the necessity for sympathetic teaching is particularly vital. Without some help and supervision the resulting dietary may become very poor, combining the worst features of both races. Teachers, doctors, nurses, and other health workers must all be alive to the needs of those who are learning to become Americans, and they must be ready to help in making the adjustment as easy and pleasant and healthful as possible.

MEXICANS

The chief foods in the Mexican diet are dried beans, chili peppers, and corn, with wheat gradually supplementing corn as a basic cereal. The unique way in which corn is prepared for consumption deserves special mention. The corn is stored in the whole kernel until the day it is to be used. Then it is placed in a lime solution and heated for about half an hour at a simmering temperature (about 200° F.), after which it is allowed to soak overnight. The corn is washed with water two or three times, and ground while wet into a dough which is shaped into flat cakes. The flat cakes or tortillas are cooked on hot stones or hot metal. The finished product contains appreciable quantities of calcium from the lime, which is retained sometimes to the extent of one half of 1 per cent calcium. Most of the germ of the corn is also intact.

Almost all of the wheat is highly milled, and Mexicans are very fond of certain types of sweet rolls. Dried beans of many varieties are eaten in significant quantities, and contribute importantly to the protein and thiamine value of the diet. Vegetables, as a whole, are not eaten in very great amounts, but tomatoes appear almost daily on the menus so that they constitute an important source of vitamin C. While chili peppers are eaten in quantities it is thought that their contribution to the vitamin C value of the diet is small. Bananas are the most commonly used fruit, although citrus fruits are consumed in quantities by the higher income groups.

Beef and chicken are the most frequently used flesh foods, pork, lamb, and fish occurring on menus only rarely. Eggs are not eaten in very great numbers. The consumption of milk is below the recommended standards, and butter is rarely used. It is to be noted that greater emphasis should be placed on the use of whole wheat, vegetables, eggs, and milk.

In a nutrition study of the food habits of people living in Mexico City it was found that but one good meal was eaten daily by most of the families.[1] The chief meal was at noon and consisted of some sort of soup which contained lentils, tomatoes, onions, garlic, noodles, and sometimes other vegetables as cabbage and turnips. Meat usually was served as a stew. Vegetables as such appeared on the menu only once or twice a week. The breakfast and supper consisted of a beverage and tortillas, the beverage being coffee with much sugar and oftentimes an appreciable amount of milk.

CHINESE

There are many Chinese living in the United States today. According to well known authorities they are people of such ancient lineage that the changing of their habits, especially their food habits, would be practically impossible.

China has been overpopulated for many generations, and the inadequacy of the food supply, even for those who could afford a better ration, has brought about the state of malnutrition which, according to Hsien Wu,[2] a Chinese chemist and physiologist of international reputation, undoubtedly exists in China today. Some of the evidences of this may be briefly summarized, namely, the small stature of the Chinese when compared with that of Americans and British, the shortness of their life-span, the high mortality among both adults and children, and their low resistance to disease, especially to such disturbances as tuberculosis and trachoma. Such evidences of poor nutrition cannot be overlooked. The Chinese as a race have survived for hundreds of years, not because of their superior food habits or other habits, but because they have always striven for large families and while in many cases the babies die of malnutrition there seem always to be others to fill their places. There are vast areas in China which are nonproductive, to say nothing of the frequency of famines and epidemics which would seemingly reduce the population; but China today is still very much overpopulated.

The economic levels in China are far apart. According to outstanding authorities, there are a few (between 5 and 10 per cent) of the fabulously wealthy, a much smaller percentage of middle classes living on a minimum economic level, and the remainder

graded downward from poor to very poor, who exist on rations which are almost unbelievably inadequate.[3]

The Chinese race as a whole likes good food. We hear of dishes such as shark's-fin soup, bird-nest soup, and ancient eggs; but these foods are for the wealthy.

There is a great difference between the food habits of North China and those of South China in the matter of cereals; the idea that rice is a native food of all Chinese is a mistake. In South China, where it can be purchased, it does form the chief carbohydrate used; but in North China wheat is far more popular. One of the foods in steady demand in South China is the native rice gruel. This porridge is used at breakfast but may be varied with little change in taste to serve at other meals.

There is little milk production in China. Chinese as a rule do not like it, and practically all that is available is given to infants and invalids. Cheese is used very little — for the most part it, too, is disliked.[4]

There are many varieties of vegetables and legumes to be found in different parts of China; if used abundantly they would materially raise the mineral and vitamin content of the Chinese diet. Calcium is necessarily inadequate owing to the small consumption and availability of milk. The soybean products are cheap and are used as meat substitutes. This bean also furnishes a large part of the milk used in the feeding of infants.

Eggs are said to be cheap in China, but the farmer is generally forced to sell the eggs that he raises rather than feed them to his family. The same is true of any other crops that the farmer raises — financial pressure makes it impossible to keep them for his consumption. The poor man of the cities prefers to spend what few coppers he may have on foods that are more satisfying to the appetite than to use them to buy vegetables. For the average Chinese meat, fish, and poultry, even when available, are usually too expensive to use. The Chinese have many methods for the preserving and drying of meat, fish, and eggs. Those living in coastal districts use fish to a greater extent than those living inland. The diet is low in fat; sesame oil or lard is used in cooking. As a rule practically no cream or butter is served — starchy foods are largely substituted because of their cheapness and availability.

The survey which was made among the middle and upper classes of Chinese points to a desire for a more adequate diet. One survey cited by Dr. Carl Crow is described. These surveys made by the American Red Cross and the Christian University (a mission school of high standing) shed much light on the kinds of foods used in the Shantung district and proved that the Chinese like vegetables, fruits, meat (particularly pork), fish, and poultry.[4]

The Chinese living in America will probably not change their food habits materially, although milk is growing in favor even in China, especially since the importation of canned and dried milk has been started. Chinese children in this country are very likely to follow the example of other children in school, and it is the hope that they will take the lesson of balanced diets home with them, thereby improving the health habits of the entire family.

The Chinese are notoriously good cooks, and many of their dishes are delicious. It is necessary in the hospital or food clinic for the dietitian or the student to ascertain the likes and dislikes of the Chinese patient if she is to hope for any success with the carrying out of a special diet, but it is doubtful if the Chinese would change his food habits, regardless of the costs.

Wherever Chinese congregate in America there are to be found, practically always, Chinese stores which import their native foods for sale. Under present conditions, however, it is doubtful if these importations will be at all commensurate with what they have been in the past; but according to Jean E. Hawks,[5] the Chinese housewife is very adaptable and, being a good cook, feeds her family well.

A last word about the dish which is commonly believed to be the prime favorite of China — chop suey is not a native dish of that country, although it is served as such in practically all Chinese restaurants of the large cities throughout the world. This dish, which was originated in a Chinese restaurant in America, was first made from the left-overs when other foods had given out. It is known to the Chinese as beggar's hash and is therefore looked upon as a culinary joke upon the foreigner who calls for it. The Chinese cook, however, has improved and more or less standardized the chop suey now in general favor and has made it one of the dishes most frequently ordered by people other than Chinese.

THE AMERICAN NEGRO

The majority of the Negroes in the United States are American, having come of several generations born in this country. So far as the food habits are concerned, it must be said that there may be a distinct difference between those of the Negroes living in the North and those who were born, bred, and are still living in the South. It is not infrequent that a southern Negro migrates to the North or the Middle West and carries, or attempts to carry, his habits of living with him. It is of the southern Negro that this outline will be given.

Background. The Negro is irregular in his food habits, frequently having only two, or even one, good meal daily. He is highly emotional in temperament and is religious to a great degree. Many, especially those lacking in education, have innumerable superstitions, a number of which are concerned with the eating of certain foods during the period of pregnancy. These taboos are very noticeable in maternity hospitals, prenatal clinics, etc., and will be discussed later.

Education is available for Negro children throughout the South. Most of the Negro schools provide at least fairly good hot lunches, and in some they are very good. All city school systems include the Negro as well as the white schools, where a uniform cafeteria is maintained in each school. The education of the Negro is going far toward improving the health status of the race. The adult is another question, for while for the most part no patients are more amenable to reason or more cooperative than the Negro patients, as soon as they are out from under the care and supervision of either the hospital attendants or the welfare nutritionist, they are likely to revert to their original habits. Old habits are difficult to break and the Negro clings to those of his forebears.

Food Habits. Corn bread is used almost invariably instead of white or wholewheat bread, the latter not being popular at all. Rice is the chief cereal grain aside from the corn meal. Molasses, Karo, and sorghum are liked and will be used if available. The majority of the Negroes are particularly fond of watermelon but not of cantaloupes or other melons. Oranges are liked and will be used if not too expensive. Grapefruit is rarely liked, and in the hospitals

grapefruit juice is not taken by Negro patients if they can avoid it.* Dried fruits are not as well liked as fresh fruits (melons and apples especially), but the Negro will eat them.

Vegetables. All kinds of greens are liked and eaten if prepared with fat meat (salted side of pork). Turnip greens, mustard greens, and cabbage are preferred, collards being next choice. Snap beans, fresh or dried black-eyed peas, and navy beans are also liked if cooked with fat meat. Other vegetables are tolerated but not purchased (except canned tomatoes, which are more or less liked). Sweet potatoes far outsell the white potatoes. The average Negro housewife, who has only a small sum with which to purchase food, will almost invariably choose greens, sweet potatoes, and salt meat for a meal. If the Negro could be induced to use just enough side meat to flavor his vegetables, it would assist materially in building up health and resistance; but at present far too much of it is used. The serving of greasy vegetables and pot liquor swimming in grease is still prevalent among the colored race. These green vegetables, especially cabbage, are cooked much too long to furnish the nutrients and vitamins as they should.

Meat. As already mentioned, pork is the favorite meat (neck bones and back bones being very popular); beef is tolerated; lamb is seldom liked and very little purchased. Chicken and other poultry are bought whenever they are possibly afforded financially.

Rabbit, squirrel, opossum, and coon are liked and eaten whenever available.

Fish is universally liked, either fresh or canned.

Milk is low in the Negro diet, not because it is disliked but because of the expense. A quart of milk will not fill the stomach and give the same sense of satisfaction as will the greens and sweet potatoes purchased for the same amount of money. Education is doing much to increase the use of milk by Negroes even among the adults, but it is still considered a luxury rather than a necessity for children.

Eggs are liked, but not so frequently used on account of their

*During one of the disastrous floods throughout the regions from Cincinnati to the Gulf, grapefruit supplied by various citrus districts for the refugees were used; but the people had to be taught to eat them, and the Negro never really learned to like or eat them at all.

cost. Butter is not used to the same extent as lard, but it is not disliked.

Desserts are liked but not used to any great extent, and salads are rarely served, although raw tomatoes will be eaten if available. Candy is well liked by almost all of the colored people of the South.

Nutritional Evaluation. The average Negro diet in the South is low in complete protein, low in calcium on account of the low milk intake, and low in some of the vitamins: first, on account of the methods used in the preparation of the vegetables; second, on account of the omission of animal foods (eggs, beef, etc.).

It must be said that while the teeth of the American Negroes are likely to be white and sound, many do develop dental caries, and rickets among Negro babies is much more prevalent than it should be. Pellagra is not an infrequent deficiency manifestation among Negroes; and tuberculosis is still a definite problem, possibly on account of their irregularity in eating, improper hygiene, and living conditions in general. By far the greatest number of Negro women nurse their babies; and it is only occasionally that the physician will not permit the mother to nurse her infant, as in cases of tuberculosis and possibly other infections. This probably has kept mortality as low as it is.

A word as to some of the superstitions noticeable in the maternity ward and prenatal clinics may serve to help the student to understand the feeding of those women when pregnant and may possibly serve to save them as well as their babies. There are those who believe that eating dry yellow clay from the chimney corners will strengthen both the pregnant woman and her child. This abnormal appetite is believed to be caused by a nutritional deficiency. It is also a common belief among the Negroes that for a lactating woman to eat mustard greens, bananas, or fish would result in the death of her baby.

RACIAL GROUPS FROM EUROPE

The material on the food habits and customs of the peoples of northern, central, and southern Europe and of the Jewish race was contributed by Mrs. Charlotte Raymond Rothwell, formerly Nutritionist, American Red Cross, and Miss Frances Stern, Director Food Clinic, Boston Dispensary, to whom the author is deeply grateful.

NATIVE BACKGROUND AND FOOD HABITS OF SOME OF THE FOREIGN-BORN AND THEIR AMERICAN ADJUSTMENTS[1]

ITALIANS

<table>
<tr><th colspan="2">Background</th><th colspan="2">Food Habits</th></tr>
<tr><td rowspan="3">Geography and Climate
(Refrigeration and preservation of food, aside from some drying and pickling, are almost unknown, due to geographical factors which make transportation, etc., difficult.)</td><td rowspan="3">1. Three sections, northern, central, and southern or Sicilian.
2. Good farming land; vineyards.
3. Warm climate, similar to California.
4. 75 per cent of population work out of doors in fields and in vineyards.
5. Many fishermen in southern section.</td><th>Native</th><th>In America</th></tr>
<tr><td colspan="2">I. Cereals, Breads, Starches</td></tr>
<tr><td rowspan="2">1. Macaroni and spaghetti.
2. Corn meal, known as polenta, a main dish.
3. Bread: flour for bread and macaroni is not refined, ground whole grain being used. Chestnut flour used in northern part.</td><td rowspan="2">1. Corn meal, polenta, used as main dish. Do not care for or use cereals such as oatmeal, Wheatena, farina, etc.
2. Macaroni and spaghetti in many shapes and forms. Use quantities with various sauces and cheese.
3. White bread, very crusty. Are using more Italian whole-wheat bread than formerly.</td></tr>
<tr><td>Reasons for Coming to the United States
(Emigrants from all countries are almost entirely from the peasant or land-working class. This is the group we are discussing here.)</td><td>1. Heavy taxes.
2. No educational opportunities.
3. Overpopulation.
4. Lure of America, the land of golden opportunity.
5. Report of relatives or friends already in the United States.</td></tr>
</table>

[1] Tables compiled and arranged by Miss Charlotte Raymond, nutritionist, American Red Cross, Newtonville, Mass., and Miss Frances Stern, director of the Food Clinic of the Boston Dispensary.

Character of People and Homelife	1. Hot-blooded, temperamental, especially in the South. Feuds flourish. 2. Emotional; eager to please. 3. Artistic; fond of good music, art, and color. 4. Father is head of family, getting first of everything. 5. Mother's chief place in life is to cook and care for family and have as many children as possible. 6. Charming, superstitious, and often poor disciplinarians. 7. Women good cooks and spend much time getting meals. 8. Roman Catholics.	**II. Milk, Cream, Cheese, Butter, Eggs**	
		1. Milk is used mainly as cheese. Children drink goat's milk. 2. Cheese in abundance, especially hard cheese. 3. No cream. 4. No butter. 5. Eggs fried or in soups.	1. Are learning to use more milk for children to drink, but not enough is used. 2. Do not like American cheese and as imported cheese is expensive, they do not use it as freely as in Italy. 3. No cream. 4. Will give butter to children. 5. Eggs, fried, plain or with peppers, spinach, etc.
Factors Influencing Conditions in the United States	1. Accustomed to out-of-door work at home, in United States they collect in cities, become laborers, fishermen, etc. 2. Although they handle more money, it costs more to live. Food is expensive. At home they had their own gardens, fruit trees, and milk supply, and they are amazed at cost of things here.	**III. Vegetables and Fruits**	
		1. Green leafy vegetables used in quantities, especially in southern portion; broccoli, escarole, salata, spinach, etc. 2. Fresh fruits used in abundance, especially in southern portion; grapes, oranges, persimmons, etc.	1. Decreased use of green vegetables and fruits, due to expense and fact that quantities must be consumed to satisfy. Have no gardens in cities. 2. Use potatoes occasionally, fried. 3. Do not like to use canned goods, except tomato paste. 4. Vegetables poorly cooked, as a rule.

Background		Food Habits	
		IV. Meats and Meat Substitutes	
		Native	In America
Factors Influencing Conditions in the United States (*Continued*)	3. Financial circumstances force them into crowded living quarters. 4. Incomes are often irregular and usually inadequate for the needs of large families, although people are industrious and thrifty. 5. Language difficulty. 6. Results are poor living conditions and poorly balanced food intake, predominating in cheap starches (macaroni, white bread), oil, and some meat and eggs to the exclusion of milk, fruits, and vegetables. Results — constipation, overweight, malnutrition. 7. If they can have own home and land, they manage nicely.	1. Use very little meat, except occasionally for feast days; then more for flavor and as an extender. Salami, bologna, sausages, etc. 2. Fish used freely along east coast and in southern section; snails, squid, octopus, clams, as well as fish. 3. Quantities of dried peas and beans used in soups and main dishes. 4. Chickens; they raise their own.	1. Very often meat, because of its greater availability, is used more extensively than in Italy to the exclusion of vegetables. Veal, salami, sausage, bologna, etc. 2. Fish is used by some, especially families of fishermen. Also use squid, octopus, snails, etc. 3. Many varieties of dried beans are used in soups and main dishes.
		V. Sweets	
		1. Very few sweet desserts, except on feast days. 2. Marzipan (almond paste) made into fancy shapes and small cakes. 3. Chestnuts.	1. Very few desserts, although they make cake. 2. Do not like milk puddings, but acquire a taste for sweets, candy, etc., here in United States.

		4. Fruit as dessert.	3. Marzipan and fancy cakes used on special occasions. 4. Chestnuts. 5. Often use fruit for dessert. 6. Spumoni (a rich ice cream which can be had at Italian restaurants).
		VI. MISCELLANEOUS — OILS, SPICES	
		1. Olive oil in quantities. 2. Some salt pork. 3. Garlic, peppers, etc., for flavor.	1. Olive oil in quantities for frying and cooking. 2. Salt pork in cooking. 3. Garlic, peppers, etc., for flavoring.
NEAR EAST — ARMENIA, SYRIA, TURKEY, GREECE			
GEOGRAPHY AND CLIMATE (Refrigeration and preservation of food, aside from some drying and pickling, are almost unknown due to geographical factors which make transportation, etc., difficult.)	1. Fairly elevated countries with many mountains, tablelands, and foothills, making communication and transportation difficult. No railroads. Use caravans. 2. Fine grazing and fertile farming land. Rich in minerals. 3. Mild climate. People live out of doors in tents March to November, raising own food.	I. CEREALS, BREADS, STARCHES	
		1. Cracked whole wheat (bourglour) and rice used plain or with meat or nuts and vegetables. Sometimes as a cereal. 2. Bread is same as that used in time of Christ, baked on griddles in round, flat loaves; also in coarse loaves, oven-baked (Greece). Finely ground whole wheat is used.	1. Cracked wheat and rice used with meat or nuts and vegetables. 2. Will give children cereal for breakfast. 3. White bread of refined flour baked on griddles same as in old country.

NATIVE BACKGROUND AND FOOD HABITS (*Continued*)

NEAR EAST — ARMENIA, SYRIA, TURKEY, GREECE (*Continued*)

Background	
REASONS FOR COMING TO THE UNITED STATES (Emigrants from all countries are almost entirely from the peasant or land-working class. This is the group we are discussing here.)	1. Persecution of the Turks in the name of Mohammed. Parts of Armenia and Syria are Christianized; hence the Turkish massacres. 2. Few women have come in, except as men already here have returned home to marry.
CHARACTER OF PEOPLE AND HOMELIFE	1. Friendly, neighborly races. 2. Makers of exquisite rugs and etched and tooled copper and brass. Rugs assume importance, because people live out so much and have little use for furniture. Use rugs a great deal. 3. Women good cooks. 4. United family life.

Food Habits	
Native	In America
II. Milk, Cream, Cheese, Butter, Eggs	
1. Milk in form of a thick sour milk (goat's milk). Leban (Syrian). Matzoon (Armenian). 2. Sour milk and hard cheeses. 3. No cream. 4. Butter made of sheep's milk.	1. Do not use enough milk. Are suspicious of bottled milk. Pasteurized milk does not make such good Matzoon. 2. Sour milk and hard cheese used somewhat. 3. No cream. 4. No butter — will give both milk and butter to children when urged.
III. Vegetables and Fruits	
1. Abundance of vegetables stuffed with wheat or rice and meats or nuts, and cooked with oil and lamb broth (squash, peppers, grape leaves, cucumbers, tomatoes, eggplant, etc.). 2. Salads with olive oil and vinegar, and free use of olives. 3. Semitropical fruits in abundance (grapes, dates, figs, oranges, etc.).	1. Plenty of vegetables used, if money permits. These are stuffed with wheat or rice, with meat, nuts, beans, etc., then cooked with oil and lamb broth (peppers, tomatoes, cabbage, and grape leaves, cucumbers, squash, etc.). 2. Few potatoes. 3. Few fruits except dried apricots, raisins, etc.

FACTORS INFLUENCING CONDITIONS IN THE UNITED STATES	These people do not become laborers to any great extent. They have pushcarts, fruit stores, antique-rug shops, are waiters, rug repairers, etc. Because of arts-and-crafts work at home, they are not so lost without out-of-door work here. Under ordinary circumstances these people are usually independent, although high cost of living often results in poorly balanced diet, high in fats and starches and low in fresh vegetables, fruits, and milk. Results: overweight, some malnutrition, and some constipation.	IV. MEATS AND MEAT SUBSTITUTES	
		1. Lamb (Kebab) is only meat used to any extent. It is usually barbecued over fire out of doors. Or is combined with cracked wheat or rice and stuffed into vegetables. 2. Nuts are used with cracked wheat or rice in place of meat (pignolias, pistachios, etc.). 3. Dried beans, peas, and lentils used somewhat.	1. Lamb (Kebab) is only meat used to any extent. Is cooked on skewers or with wheat or rice. Sometimes is ground and eaten raw with cracked wheat. (Some chops; no roasts, etc.) 2. Combined with cracked wheat or rice served instead of potato, stuffed into vegetables, etc. 3. Nuts are used in place of meat with cracked wheat and rice. 4. Dried peas, beans, lentils used somewhat.
		V. SWEETS	
		1. Honey used for sweetening. Molasses made from grapes. 2. Few desserts except on special occasions. 3. Paklava (pastry with nuts and honey). 4. Fruit compotes. 5. Fruit candies and Turkish paste.	1. Both honey and sugar used for sweetening. Molasses made from grapes. 2. Use few desserts. 3. Fruit compotes. 4. Paklava (pastry with nuts and honey) or shredded wheat with nuts and honey-bread and honey with cream can be bought at restaurants and bakeries. 5. Apricot candy, Turkish paste.

NATIVE BACKGROUND AND FOOD HABITS (*Continued*)

NEAR EAST — ARMENIA, SYRIA, TURKEY, GREECE (*Continued*)

Background		Food Habits: Native	Food Habits: In America
		VI. Miscellaneous — Oils, Spices	
		1. Sheep's butter. 2. Olive oil. 3. Many and varied spices. 4. Turkish coffee.	1. Olive oil used a great deal. 2. Many and varied spices in combination. 3. Turkish coffee.

JEWISH PEOPLE — FROM RUSSIA, POLAND, GERMANY

		I. Cereals, Breads, Starches	
GEOGRAPHY AND CLIMATE (Refrigeration and preservation of food, aside from some drying and pickling, are almost unknown, due to geographical factors, making transportation, etc., difficult.)	1. Russia, Poland, Germany. 2. The Jewish race originated in a small area in Egypt. Then they went to Palestine, and after the fall of the Temple they went all over the world, driven from one country to another. Jews are loyal to the country of their adoption.	1. Barley, Kasha (buckwheat) in soups. Corn meal, oats (Polish). 2. Noodles and other egg and flour mixtures. 3. Dark rye bread (Russian and German). Pumpernickel (German and Russian). 4. Unleavened bread (matzoth) at Passover.	1. Oatmeal and farina used as breakfast food. 2. Barley, Kasha (buckwheat) in soups. 3. Noodles and other egg and flour mixtures. 4. Rye bread and white seed rolls. 5. Matzoth — unleavened bread — at the Passover.

<table>
<tr>
<td rowspan="2">Reasons for Coming to the United States
(Emigrants from all countries are almost entirely from the peasant or land-working class. This is the group we are discussing here.)</td>
<td rowspan="2">1. Depending upon country from which they come. Since 1890 large percentage of Jews came from Russia and Poland. Before that many came from Germany.
2. Persecution
3. Lack of educational opportunities, etc.
4. Lure of America, land of liberty and opportunity.</td>
<td colspan="2">II. Milk, Cream, Cheese, Butter, Eggs</td>
</tr>
<tr>
<td>1. Use of milk dependent on country; land-workers usually have abundance of milk.
2. Cream cheese and cottage or pot cheese.
3. Sour cream on vegetables, berries, and in soups.
4. Sweet butter.
5. Eggs in soups, noodles, etc.</td>
<td>1. Use milk plentifully if they can afford it.
2. Cream cheese and cottage cheese.
3. Sour cream if able to buy it.
4. Sweet butter preferred.
5. Eggs, plain, in soups, noodles, etc.</td>
</tr>
<tr>
<td rowspan="2">Character of People and Homelife</td>
<td rowspan="2">1. Although scattered over the earth, the Jews are very race-conscious.
2. Very close and beautiful home life. Emphasis on spiritual things.
3. Unusually bright and intelligent, as a whole.
4. Ambitious, somewhat emotional people, especially the Russian Jew.
5. Characteristics moulded by religious precepts and difficulties of generations driven from one place to another.</td>
<td colspan="2">III. Vegetables and Fruits</td>
</tr>
<tr>
<td>1. Root vegetables (onions, beets, turnips), cabbage, etc., cooked with meats and in soups (Borsch).
2. Some raw vegetables, as lettuce, tomatoes, cucumbers, eaten with sour cream when available.
3. Dried fruits (prunes, apricots, peaches, pears, cherries, and apples).
4. Pickled and salted vegetables (cucumbers, tomatoes, sauerkraut, etc.).</td>
<td>1. Root vegetables used in soups (Borsch) and with meats.
2. Raw vegetables (lettuce, cucumbers, tomatoes, etc.) used frequently.
3. Use potatoes with meat.
4. Dried fruits, oranges, apples, pears, grapes, plums, etc.
5. Pickled and salted cucumbers, tomatoes, relishes, etc.</td>
</tr>
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NATIVE BACKGROUND AND FOOD HABITS (*Continued*)

JEWISH PEOPLE (*Continued*)

Background		Food Habits: Native	Food Habits: In America
		IV. Meats and Meat Substitutes	
Factors Influencing Conditions in the United States	1. Thrifty, industrious, ambitious as a whole. 2. Very few work in laboring jobs. Have own stores, pushcarts, business such as tailoring, clothes-making, etc. 3. Financial problems not generally as acute with these people as in the case of Italians. 4. Inadequate income results in poorly balanced diet, high in starches and fat and very deficient in fresh fruits and vegetables. Many Jewish people are overweight and constipated, and there is a higher incidence of diabetes than in any other race.	1. Meat and poultry in any country, killed and prepared according to religious laws. Can use only clean or Kosher meat (animals that chew the cud and divideth the hoof). Beef, veal. Non-Jewish people from these countries also use pork. 2. Cheaper cuts only used. (Jews cannot use hind quarter of animal.) Meat cooked with vegetables. 3. Jews cannot use meat and dairy products at same meal. 4. Jews use a great deal of chicken, always on Sabbath eve (Friday). 5. Use meat soups.	1. Meat and poultry chosen, killed, and prepared according to religious law (Kosher). 2. Cheaper cuts used (hind quarters not used). Meat is boiled or cooked with vegetables. 3. Cannot use meat and dairy products at same meal. 4. Use chicken, especially on Sabbath eve. 5. Use meat soups. 6. Use internal organs. 7. Fresh-water fish, cod, haddock, smoked and salt fish, salmon. 8. Dried peas and beans and lentils, used especially in soups, etc.

	5. Influence of religion must always be considered, as it affects food habits and life as a whole. There are many religious holidays and fast days. Jewish people grew up leaning on the Old Testament, their religious laws and compilations. Their laws were based upon interpretation of the Bible. There are precepts in the Bible for all Orthodox dietary laws.	6. Use internal organs (chopped liver). 7. Fresh-water, smoked, salted, pickled fish, herring, salmon, pickerel, carp, whitefish. 8. Dried beans, split peas, and lentils, especially in soups.	
		V. Sweets	
Factors Influencing Conditions in the United States Religious Laws	1. *Genesis:* Noah taking animals from the ark clean (Kosher), unclean (trafa). All animals eaten must be Kosher or clean (animals that chew the cud and divide the hoof), and they must be killed and prepared in a prescribed manner.	1. Rich pastry rolled with nuts, fruits (Streudel—German). 2. Dried fruits (prunes, pears, cherries, etc.). 3. Pancakes (Blintzen — Russian). 4. Cheese cake. 5. Sponge cakes and macaroons (at Passover without wheat flour).	1. Rich pastry rolled with nuts and fruits (Streudel). 2. Dried fruits. 3. Cheese cake. 4. Sponge cakes and macaroons at Passover.
		VI. Miscellaneous — Oils, Spices	
		1. Chicken fat used extensively. 2. Oil used some. Flaxseed oil (Polish). 3. Seasonings and many relishes. (Horseradish used somewhat.)	1. Chicken fat, vegetable oil, Crisco. 2. Highly seasoned food. 3. Many relishes, as horseradish.

NATIVE BACKGROUND AND FOOD HABITS (*Continued*)

Jewish People (*Continued*)

Background		Food Habits	
		Native	In America
Religious Laws (*Continued*)	2. *Exodus and Deuteronomy:* Must not seethe the kid in its mother's milk. Orthodox Jewish people cannot use meat and dairy products at the same meal. Separate utensils must be used in the preparation and serving of meat meals and milk meals. 3. Cannot eat hind quarter of animal, for Jacob had his thigh injured when wrestling with the angels. 4. No milk or dairy products can be eaten until 6 hours after meat. 5. Must rinse mouth after eating fish before eating meat. 6. No wild food can be eaten. 7. No fish without scales can be eaten (no lobsters, clams, oysters, eels, etc.).		

PROJECTS

1. Select any one nationality group and plan menus for one day including recipes for special dishes.

2. Special problems may be worked out in correlation with diet therapy. For example: plan a diet for a Mexican man who has peptic ulcer; plan a diet for an Italian woman who has nephritis.

REVIEW QUESTIONS

1. What food constituents are apt to be missing in the dietary of these racial and nationality groups living in America: Jewish, Italian, Chinese, Mexican, Negro?

2. What measures can you suggest for the correction of the deficiencies mentioned in question 1?

3. What factors must be kept in mind in teaching normal nutrition to people of widely differing food habits than our own?

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CHAPTER XIII

Safeguarding the Food Supply

FOOD POISONING

That an adequate supply of food is essential for the health and well being of man has been established. Equally well recognized is the fact that food is an occasional cause of disease. The ancient Egyptians realized that meat of animals which had died a natural death was unfit for human food. Greek records of many centuries ago note that the wife, daughter, and two sons of the Greek poet Euripides, died after having eaten poisonous fungi by mistake. In the present day everyone is familiar with the sporadic outbreaks of botulism, typhoid fever, metal poisoning, and many other food-borne diseases.

Illness which sometimes results from the eating of food may be caused by bacterial contamination or parasitic infestation of the food, by the presence of some poisonous chemical in the food, or by sensitivity of the individual to a given food or foods. Poisoning by bacterial, parasitic, or chemical agents in food will be discussed here, while the subject of allergy is considered in more detail in Chapter XXXV.

Bacterial Contamination of Foods. Pathogenic bacteria may be carried into the body by means of contaminated food or water. Typhoid fever, dysentery, tuberculosis, diphtheria, and scarlet fever are but a few of the diseases which may be transmitted by foods which have been handled in an unsanitary manner. In other instances certain animal infections are transmitted to man through the milk supply, undulant fever and streptococcic sore throat being examples.

Bacteria of the *paratyphoid* group are frequently responsible for gastro-intestinal upsets which may occur from five to twenty-four hours after ingestion of the contaminated food. It is thought that the toxins produced by the bacteria rather than the bacteria them-

selves are responsible for the illness. These disturbances are characterized by nausea, vomiting, fever, abdominal pain, and diarrhea. Fortunately, the disease in most instances is of short duration and seldom fatal.

Staphylococci, especially staphylococcus aureus, have repeatedly been the offending organisms in illness similar to that described above. The most favorable media for growth of these organisms are semi-solid foods such as cream fillings and ground meats in which the bacteria quickly penetrate the entire mass. "Food poisoning" is more prevalent in the summer months because bacteria multiply much more rapidly at warmer temperatures.

The prevention of illness caused by staphylococcic or paratyphoid contamination of foods depends upon scrupulous measures for cleanliness and proper refrigeration. The purification of water supplies and pasteurization of milk has reduced very greatly the incidence of milk- and water-borne diseases. The hands should always be washed before food is handled, and implements for eating should never be placed in the common food supply after they have been used for tasting. Typhoid carriers should not be permitted to handle food. The medical examination of food handlers before employment is a wise precaution whenever meals are prepared for large groups of people as in hospitals and restaurants. Careful instructions for cleanliness of person and sanitary practices while working should be given to all employees.

Botulism is a very serious, but fortunately rare, type of food poisoning caused by the toxins of the *bacillus botulinus.* These bacteria are found in soils all over the world, and consequently infect fruits and vegetables grown thereon. The spores produced by the bacillus are relatively heat resistant, and they will develop rapidly under anaerobic (without oxygen) conditions such as are found in canned foods. The toxins produced are extremely poisonous, and it has been estimated that as little as $\frac{1}{100}$ milligram may prove fatal to man. The toxin must be produced in the food before it is consumed. The symptoms of intoxication usually do not appear until 12 to 18 hours after eating the food, and are most frequently characterized by nervous symptoms which include paralysis of the muscles of the pharynx, larynx, tongue, intestine, and lungs. Great muscle weakness invariably results.

Foods which contain little or no acid such as meat, beans, asparagus, corn, and peas are very good media for the growth of the bacillus botulinus, while acid-containing foods as tomatoes and certain fruits are not favorable for growth. The processing of canned vegetables in boiling water is not adequate for destruction of spores, and therefore the use of sterilization with steam under pressure should be urged for the home as well as for commercial establishments. Most cases of botulism at the present time occur as a result of the consumption of improperly canned vegetables in the home. In fact no cases of botulism from commercially canned foods have been reported since 1925. It goes without saying that any food which shows gas production, or change in color or consistency should be destroyed without even tasting it. The contents of any can which has bulging ends should likewise be discarded. It is important that such foods be burned since animals eating them will otherwise be poisoned. Home canned vegetables should be brought to a vigorous boil before being used since the botulinus toxin is inactivated in six to ten minutes by heat at 80° C.

Ptomaine Poisoning. The designation of "ptomaine poisoning" is falsely applied to almost any sort of illness resulting from the consumption of food. Ptomaine comes from the Greek word "ptoma" meaning dead body. True ptomaines are nitrogenous products which are formed in the later stages of food decomposition, but the foods are so obviously spoiled that people would refuse to eat them. Ptomaines have never been shown conclusively to produce illness when they are given by mouth, although their injection in experimental work has sometimes led to illness.

Parasitic Infestations of Food. Many animal parasites gain admission to the body by means of food. Among them are *Endamoeba hystolytica* which causes amoebic dysentery, and various worms such as beef and pork tapeworm, pinworm, and Ascaris.

Trichinosis is one of the most serious of worm infestations which results from eating raw or partially cooked pork infected with *Trichinella spiralis*. Autopsy reports indicate that the disease is much more common than is generally believed. The worm invades the muscle fibers with resulting muscle tenderness. The muscles of the larynx, tongue, lungs, diaphragm, and heart may become affected. As the worm becomes embedded the symptoms disappear

n large part. Characteristic symptoms include edema of the eyelids, evere headache, and marked eosinophilia.

Trichinosis may be avoided by eating only those pork products which have been thoroughly cooked. Government inspection of neat does not include examination for trichinella since it is impracical to do so at the present time.

Chemical Poisons. Insect sprays which are used on fruits and vegetables may be a source of poisonous metals such as arsenic and lead. While attempts are being made to reduce the amount of these metals which may be used as well as to find substitutes for them, it must be emphasized that all fruits and vegetables should be thoroughly washed before they are eaten.

Lead is a particularly dangerous metal since it accumulates in the body and results in chronic illness characterized by severe anemia and changes in the kidneys and arteries, death occurring in some cases. A minute quantity of lead occurs naturally in food and is ingested daily, but whenever the daily intake is one milligram or more the eventual accumulations may become toxic. Food may become contaminated with lead if it is exposed to dust containing lead, or if it is kept in containers in which solders, alloys, or enamel containing lead have been used. Canned foods were formerly subject to lead contamination, but the canning industry has long since devised containers which are entirely safe for food.

There has been much controversy about the toxicity of aluminum, but experimental evidence indicates that the amount of aluminum which may be dissolved out in the usual cookery of foods is not deleterious to health. This is also true of zinc and tin. It is highly desirable, however, to make every attempt to keep the concentration of these metals at a minimum.

Chemical Poisons in Plants and Fish. Another type of poisoning occurs from the consumption of plants which contain some poisonous alkaloids such as strychnine, atropine, scopolamine, solanine, and others. Varieties of hemlock have been mistaken for parsley, horseradish, or wild parsnip and eaten in salads or soup only to produce immediate illness which was often fatal. Monkshood, foxglove, and deadly nightshade have from time to time been mistaken for edible plants and caused violent illness.

The increased consumption of mushrooms has led to more fre-

quent poisonings by fungi, for many people are unable to distinguish the very poisonous *Amanita* from the harmless varieties. One type of poisonous mushroom within one to three hours produces symptoms such as profuse perspiration, salivation, abdominal pains, nausea, and vomiting. The mortality in this group is low. A second type of mushroom brings about extreme nausea and vomiting, severe abdominal pains and diarrhea with extensive damage to the kidneys and liver. Fifty per cent or more of the individuals so affected die.

The green part of sprouting potatoes contains sufficient solanine to produce pain, vomiting, jaundice, diarrhea, and prostration. Rhubarb leaves contain appreciable quantities of oxalic acid, and should not be used in place of other greens since serious illness usually results.

Mussels from the Pacific coast extending from Alaska to California contain one of the most poisonous alkaloids known.

PRESERVATION OF FOODS

Food spoilage is brought about by the action of molds, yeasts, and bacteria, the latter presenting the greatest problem in food preservation. Cooking and canning, freezing and cold storage, dehydration, and preservation with chemicals have all been employed to preserve various foods. One must be concerned not only with the safety of the food but also with the nutritive value of the food after it has been subjected to any given process of preservation.

Canning. While cooking of food for a sufficient period of time will destroy bacteria, products will quickly become recontaminated if they are exposed to the air. The sealing of food into cans and the subsequent sterilization makes it possible to store foods for many months. Commercial firms now employ standard methods of canning for each food, all sterilization being brought about by means of steam under pressure. As a result there have been no serious outbreaks of food poisoning because of inadequate sterilization of commercially canned products for many years. Pressure cookers should be employed with equal vigilance in home canning of fruits and vegetables, but unfortunately this has not always been possible. The hot-water-bath method of processing non-acid vegetables as corn, peas, and string beans is not adequate for the destruction of

spores such as those of the botulinus bacillus. A safeguard against poisoning from home canned vegetables is the practice of routinely boiling the canned products for five to ten minutes before they are even tasted.

The canning of foods sometimes results in small losses of nutritive value. The vitamin A content does not appear to be affected, and the losses for thiamine and ascorbic acid are not as great as has been supposed. Meats have been shown to be much lower in thiamine content after two hours of processing, but vegetables are much more stable since the pH of the latter is lower. Commercially canned foods will show less losses of vitamins than home canned foods since it is possible to use vacuum closure, whereas a small amount of air is retained in the home canned product so that continuing oxidation occurs. Greater loss seems to occur in products packed in glass than in those packed in tin.

That canned foods retain a great deal of their nutritive value is proven by the fact that several generations of rats and guinea pigs have thrived on a diet consisting of canned foods only.

Freezing. For many years it has been the practice to freeze some fruits for later use in jellies and jams. Frozen foods have been appearing in ever increasing variety in recent years. The food to be frozen is carefully selected for proper maturity and perfect quality. The vegetables are blanched for a minute or so to inactivate enzymes which are always present and are then quickly frozen, and stored at 0° C. or lower. The loss of vitamins in the blanching process is relatively small, but loss of vitamin C occurs to a marked degree when the food is thawed slowly. It is important, therefore, to keep vegetables in the frozen state up to the time they are to be cooked. Bacteria are not killed by the low temperatures, but remain inactive until thawing occurs. Consequently, foods should never be refrozen once they have been thawed, nor should they be allowed to remain long in the thawed state before they are used.

Cold Storage. Food may be preserved for long periods of time in cold rooms such as those utilized by commercial firms for meat, eggs, fruits, and vegetables. Fruits and vegetables are kept just above the point at which they will freeze, this being in most instances one or two degrees below the freezing point for water. Meats, however, may be kept in the frozen state. It is true that cold storage eggs are

often of better quality than so-called fresh eggs which have not been properly cared for.

Root vegetables in the home may be stored all winter if one has a cold cellar which can be used. It should be realized that significant losses of vitamins, especially ascorbic acid, occur in such foods.

Dehydration. The removal of water from foods is an effective means of avoiding spoilage since micro-organisms cannot grow in the absence of water. Certain fruits as prunes, apricots, peaches, apples, figs, dates, and raisins as well as the legumes have been dehydrated for centuries. Such drying results in almost complete destruction of vitamin C and very large losses of carotene. Whenever sulfur dioxide is used in the drying process ascorbic acid is protected but thiamine is completely split up. Milk and eggs may be dried with success. Many other foods have been dried for use by the army, but their exact worth to civilian populations has not been ascertained. The palatability of such products together with the retention of food values are problems for further research.

Chemical Preservation. Sugar is employed in high concentrations for the preparation of jams, jellies, and preserves. The water is made unavailable to the micro-organisms and hence spoilage will not occur. However, molds will grow on the surface of these foods if sterility is not maintained. Sodium chloride and vinegar are also good preservative agents as employed in brining and pickling.

The number of chemicals which may be used for preservation is now strictly limited by government regulations. Benzoic acid or sodium benzoate may be used up to a concentration of 0.2 per cent if labels specifically indicate its use. Sulfur dioxide may be used in the drying of apples to lessen darkening. Meats may be cured with smoke which contains phenols. Spices such as cloves and cinnamon have been much over rated for their preservative properties, since concentrations sufficient to inhibit bacterial growth would render the food inedible.

FOOD LEGISLATION

The ever increasing production of foods outside the home has necessitated regulations for commerce. In the late nineteenth century serious frauds were practiced on the public. Some of them included the coloring of lard and selling it for butter, the adultera-

tion of most cocoa and chocolate, the sale of Vermont syrup in quantities ten times the actual production, and the use of colorings and preservatives which were harmful to health. These flagrant abuses led the Federal Government in 1906 to enact two laws for the control of the manufacture, sale, or transportation of food whenever interstate or foreign commerce was concerned. These laws included the Meat Inspection Act and the Food and Drugs Act.

Federal Food, Drug, and Cosmetic Act. The Food and Drugs Act was replaced in 1938 by the Food, Drug, and Cosmetic Act. It is an "act to prohibit the movement in interstate commerce of adulterated and misbranded food, drugs, devices, and cosmetics, and for other purposes." Under this act the Department of Agriculture may set up standards of identity and quality of food, as well as specifying quantity for a given container. Fresh or dried fruits and vegetables are exempt from this regulation, although standards relating to maturity and effects of freezing may be established for avocados, cantaloupe, citrus fruits, and melons.

A food is considered to be *adulterated:* (1) if it contains any poisonous or deleterious substance injurious to health; (2) if it consists of any filthy, putrid, or decomposed substance; (3) if it is packed under unsanitary conditions so as to contaminate it; (4) if diseased animals have been used in preparation; (5) if the container is made of a poisonous substance which will render the contents harmful; (6) if valuable constituents have been omitted; (7) if substitutes have been used to conceal inferiority; (8) if it contains coloring other than that permitted by law.

Misbranding has occurred for food: (1) if the labeling is false; (2) if the food is sold under another name; (3) if imitations are not clearly indicated; (4) if the size of the container is misleading; (5) if manufacturer, packer, or distributor is not listed on package forms; (6) if statement of weight, measure, or count is not given; (7) if it is below standard without indication of substandard quality on the label; (8) if it fails to list vitamin and mineral value when it is supposed to be for special dietary purposes; (9) if it fails to list artificial flavorings, colorings, and preservatives. Butter, cheese, or ice cream may be colored without specific indications therefor.

Federal Meat Inspection Act. Meat inspection was first instituted because certain European countries demanded official inspec-

tion of American meats before their exportation. The Meat Act provides for inspection of all meat in interstate trade as well as for imported and exported meats. The present law provides for (1) the inspection of animals intended for slaughter; (2) the inspection of carcasses and all meat products; (3) enforcement of sanitary regulations; (4) guarding against the use of harmful preservatives. This inspection takes care of two thirds of the nation's supply of beef, veal, mutton, lamb, and pork. Meat which is sound and wholesome is stamped "Inspected and Passed", while that which is unfit for human consumption is marked "Inspected and Condemned". Of the 72,244,260 animals slaughtered annually during 1930 to 1939 an average of 230,741 carcasses were condemned and destroyed. This gives some idea of the importance of meat inspection.

State and Community Legislation. All foods which are produced for consumption within a state or community are subject only to the laws of that state or community and do not come under the jurisdiction of the Federal government. These local laws vary widely.

Milk usually is under control of state and municipal authorities only. Legislation concerning it should include adequate control of sanitation, maintenance of nutritive value, and prevention of fraud. Sanitary inspection should include examination of the cow to detect diseases such as tuberculosis, Bang's disease. High standards for cleanliness of barns, utensils, health and cleanliness of milkers, and bacterial counts of milk must be maintained. Pasteurization should be carried out for all milk.

Home care of the milk is most important. The milk should be set in a cold part of the refrigerator immediately after delivery. Milk from a partly used container should not be mixed with fresh cold milk.

The American Medical Association has a Council on Foods which publishes general decisions concerning food products for the guidance of members of the association and of the public.

SUMMARY

Food poisoning may be caused by bacterial contamination of food through unsanitary practices. The purification of water sup-

plies and pasteurization of milk reduces markedly the incidence of infections. However, one cannot overemphasize the importance of clean utensils, and clean surroundings for food preparation in the home, restaurant, or hospital. Of equal or even greater importance is the maintenance of highest standards of cleanliness and health for all personnel who handle food.

Botulinus poisoning can be prevented with certainty only when canned foods are sterilized with steam under pressure for a specified length of time to destroy the spore itself. Failure to take these precautions sometimes leads to fatal illness after eating home canned vegetables and meats.

Trichinella infestations of pork are common, but trichinosis will not occur if pork is always well cooked.

Canning, freezing, cold storage, dehydration, and chemical treatment are methods for preservation of foods. Dehydration and chemical treatment are less widely used than canning and freezing.

Federal, state, and community legislation is of fundamental importance for the assurance of food supplies which are not deleterious to health, the maintenance of standards with respect to nutritive value, and the avoidance of fraud. Every nurse should be keenly interested in the promotion of such regulations as are designed to safeguard the food supplies.

PROJECT

Determine what regulations exist in your own community for the sale of milk. List several other laws which are designed to safeguard the local food supply.

REVIEW QUESTIONS

1. List several ways in which bacterial diseases may be transmitted by foods.
2. What organisms are responsible for most cases of summer food poisoning?
3. Formulate several rules which might be enforced in the prevention of food-borne diseases.
4. Explain what is meant by botulism. Which types of food are most apt to contain botulinus toxin? What measures are necessary to eliminate the possibility of botulinus poisoning?

5. What is ptomaine poisoning?

6. Describe the effects of trichinella infestation. How can it be avoided?

7. Lead and arsenic are especially poisonous to man. In what ways do they sometimes contaminate food supplies?

8. Name several plants which are poisonous to man. What type of chemical compound produces this poisoning?

9. What are the causes of food spoilage?

10. Why are commercially canned foods likely to be superior in their vitamin content to home canned foods?

11. Which method of canning is preferable for home use? Why?

12. Discuss the uses of cold storage for various foods.

13. Why do dehydrated foods keep so well?

14. What losses of nutritive value occur in dehydration?

15. Name five chemical agents frequently used for preservation.

16. What is the object of the Food, Drug, and Cosmetic Act? Under its provisions what is meant by misbranding? By adulteration?

17. What provisions are included in the Meat Inspection Act?

18. Discuss the importance of state and community legislation.

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SECTION II

Normal Nutrition in Special Conditions

CHAPTER XIV

Pregnancy and Lactation

Pregnancy and lactation are normal conditions which, however, make greater demands upon the body of the woman than is normally required. The effect of maternal nutrition upon the development of the fetus, the health of the infant, and the occurrence of complications of pregnancy was strikingly brought out in a study made in the prenatal clinic of the Boston Lying-In hospital by Burke, Beal, Kirkwood, and Stuart.[1] This study was made on 216 pregnant women over an extended period during which the women were examined and their diets were analyzed at frequent intervals. The diets were rated as excellent if they contained 100 per cent of the optimal standards for each of the nutrients. Ratings of good, fair, poor, and very poor were given to diets containing 80, 60, 50, and less than 50 per cent, respectively, of the optimal levels for the food constituents.

Their studies indicate that a woman who has a poor or a very poor diet during pregnancy will in all probability have a poor infant; that is, prematurity, congenital defects, and stillborn infants occurred almost entirely in this group. On the other hand, the woman who had good to excellent diets almost invariably bore infants in good physical condition. Inadequate nutrition during pregnancy resulted in relatively greater harm to the fetus than to the mother. This finding is contrary to former beliefs that the fetus always develops at the expense of the mother. It is of further interest that no cases of eclampsia were noted in those women receiving excellent or good diets, whereas 50 per cent of those receiving poor or very poor diets developed toxemia of varying degrees of severity.

PREGNANCY

The pregnant woman gains on an average from 15 to 20 pounds during the period of gestation, most of this gain occurring in the

last three months of pregnancy. The gain in weight of the fetus is only about a gram a day at first, but by the sixth month the rate of gain reaches 10 grams a day. Investigations show that about half of the weight of the developing baby is accomplished during the last eight weeks before birth.

Factors to Be Considered During Pregnancy. The health and well being of the expectant mother, and the growth and development of the unborn child constitute the chief points for consideration. To accomplish these aims, definite nutritional factors must be considered: (1) the daily amount and the quality of protein needed; (2) the necessary calories to be included in the daily diet in order that the mother's body and that of the developing fetus may be safeguarded; (3) the type and amount of minerals and vitamins which are essential and how to provide them in the daily menu.

Protein Allowance. Pregnancy represents one of the important periods of growth; therefore it is necessary that the protein intake be adequate in both quality and quantity. The foods furnishing the protein must contain a sufficient amount of all the essential amino acids to maintain the mother's tissues and provide for the building of new tissues of the developing fetus. The allowance of protein ranges from 1¼ to 1½ Gm. per kilogram of body weight per day. An average of 85 Gm. per day throughout the latter half of pregnancy is advised by the Food and Nutrition Committee of the National Research Council.[2]

Energy Allowance. It is usually not necessary to increase the caloric intake during the early months of pregnancy since most of the gain in weight occurs during the latter half of the period of gestation. By the ninth month of pregnancy the metabolism will have increased gradually to as much as 20 to 25 per cent over the normal rate of energy exchange. The Food and Nutrition Committee of the National Research Council recommends an intake of 2500 calories per day while other authorities advise from 2600 to 2800 calories per day depending upon the woman's increase in body weight.

Mineral Allowances. The development of a new body calls for building materials for both muscular and skeletal tissues, and these materials must be furnished in the diet of the expectant

mother. Calcium, iron, and iodine are materials to be stressed in the diet; others are also needed — such as copper, sulfur, and phosphorus — but they will be supplied if the diet contains adequate quantities of protein, calcium, and iron. Some of the demands for increased minerals such as calcium and phosphorus extend several months beyond the period of both pregnancy and lactation. The weakening of the teeth and bones of the expectant mother is due primarily to the withdrawal of these minerals from her body to cover the needs of the developing fetus. When the diet of the mother is adequate in quality and quantity the storage of calcium is large during the last three months of pregnancy, but if her diet is not adequate and the mobile reserve of calcium is lacking, the demands of the fetus cannot be met.[3] The bones and teeth of the developing infant must depend upon the maternal organism for the building materials. The first set of teeth begin to form before the eighth week of prenatal life, and according to McCollum and Simmonds:[4] "By the fifteenth week the enamel organs have appeared. The six year molars, the first of the permanent teeth to be erupted, are beginning to calcify about the time the child is born." Likewise, a well formed arch of the jaws and good strong enamel depend largely upon the utilizable calcium, phosphorus, and vitamin D in the diet of the mother; when she is underfed or misfed, the consequence to both mother and infant might easily prove disastrous.

The amount of calcium required per day is 1.5 Gm. according to the National Research Council. The phosphorus requirement is also in this range. The need for iron is placed at 15 mg. per day if a factor of safety is to be insured. Many physicians advise the giving of iron salts in addition to the food iron to assure the health of the mother and to provide blood building materials and storage iron for the fetus.

Iodine, an essential constituent of thyroxin, exerts a powerful influence on metabolism, and is therefore most important in the diet during pregnancy. If the diet does not contain liberal amounts of seafoods or other iodine-rich foods, it is necessary to use iodized salt daily.

Vitamin Allowances. An increased amount of all of the vitamins in the diet during pregnancy has come to be recognized as

an essential means for safeguarding both the mother and the child. Care must also be exercised to prevent undue loss of these vital elements during preparation of the diet. The following daily intake has been recommended:

Vitamin A	6000 I.U.
Thiamine	1.8 mg.
Riboflavin	2.5 mg.
Niacin	18 mg.
Ascorbic acid	100 mg.
Vitamin D	400–800 I.U.

Selecting the Daily Diet. The diet for normal pregnancy during the first three months need not be different from the average normal diet for adult women, but increases must be made in all of the dietary essentials beginning with the fourth month. As a rule a gain of 15 to 20 pounds is made during normal pregnancy, and it becomes necessary to watch the patient's weight for proper adjustment of the caloric intake. When the patient proves to be allergic to certain foods, it is necessary to make substitutions with the greatest care in order to maintain good nutrition. This is particularly true with the protein foods, for the essential amino acids must be provided in order that the building and development of the fetus can be maintained.

NORMAL DIET FOR PREGNANT WOMEN

Include these foods daily:

1 quart milk
1 large serving (4 to 5 ounces) meat, fish, or fowl
2 eggs or 1 egg and a substitute of cheese, meat, or fish
1 ounce butter or fortified margarine
3 servings whole-grain or enriched cereals and bread
3 servings fruit, two of which should be citrus or tomato
4 servings vegetables:
- 1 to be potato
- 1 to be uncooked or tomato
- 1 to be green or yellow
- 1 to be as desired

Other foods, as desired, to furnish adequate calories

TYPE DIET

Breakfast

Fruit
Cereal — preferably whole-grain or enriched
Milk for cereal
Egg
Toast or roll with butter or fortified oleomargarine
Hot beverage with cream and sugar, if desired

Midmorning

Milk with crackers

Luncheon or supper

Egg or substitute of cheese, meat, fish, or fowl
Potato, rice, spaghetti, noodles, or macaroni
Green or yellow vegetable—preferably raw
Bread — whole-grain or enriched — with butter
Milk
Fruit

Midafternoon

Milk

Dinner

Orange, grapefruit, or tomato juice—1 cup
Meat, fish, or fowl
Potato
Vegetable—raw or cooked
Bread — whole-grain or enriched — with butter
Dessert
Milk

Before retiring

Milk with crackers

The milk for between meal nourishments may be served plain, as eggnog, or flavored with chocolate or coffee. Peanut butter and yeast sandwiches add to the iron and vitamin value of the diet and may be substituted for the crackers in the nourishments. Tomato juice with brewer's yeast likewise increases the intake of vitamins. Liver should be served at least once a week since it is such a valuable source of iron, vitamin A, and vitamins of the B

complex. Apricots, peaches, and prunes, whether fresh or dried, are valuable for their available iron content.

COMPLICATIONS OF PREGNANCY

Toxemias occur in certain cases of pregnancy and special dietary measures must be instituted to overcome them. These toxemias may be accompanied by such findings as hypertension, edema, and nephritis. Other complications of pregnancy include gross gain in weight, constipation, nausea, and vomiting which may be mild or severe.

Excessive Gain in Weight. Perhaps the best way to cope with this complication is to avoid it by a careful adjustment of the daily caloric intake. If weight gain continues to be excessive it becomes necessary to further restrict the calories to 1500-1800 per day. The foods must be chosen with care to insure the inclusion of the daily quart of milk, as well as the necessary fruits, vegetables, whole-grain cereals, egg, and meat.

Constipation. The normal diet outlined above for pregnancy contains a liberal allowance of cellulose which is helpful in promoting peristalsis. It is also necessary to stress the daily intake of at least 6 to 8 glasses of water, the importance of regular habits of exercise, elimination, sleep, and recreation.

Nausea and Vomiting. Throughout the early weeks or months of pregnancy nausea and vomiting are not at all uncommon. Such conditions should be minimized as much as possible. Mild early morning nausea may usually be overcome by the use of high carbohydrate foods such as crackers and jelly, hard candies, and dry toast before arising in the morning. It has also been found that a limitation of fatty and rich foods in the daily diet will be beneficial.

When nausea is severe and vomiting becomes more or less pernicious, feeding by mouth may be impossible, but the nutritional status may be partially maintained by the use of glucose solutions given intravenously or subcutaneously. Recent therapy by parenteral routes includes the use of amino acid hydrolysates, minerals, and vitamin concentrates. The use of tube feedings consisting of 5 to 10 per cent solutions of Karo water, gruel, milk, or Dryco has been suggested.[5]

As soon as the patient is able to eat, a high carbohydrate low fat diet will usually prove to be well taken. The following outline will direct the administration of such a diet.

HIGH CARBOHYDRATE DIET WITH FREQUENT FEEDINGS[6]

General rules:

Allow food to be given in small portions every two hours throughout the day and once or twice during the night.
Particular attention should be given to the early morning feeding and the bedtime feeding since fasting aggravates the condition.
Consult the patient frequently as to likes and dislikes since foods which are appealing to the appetite are more likely to be retained.
Give foods that are easily digested.
Serve solid and liquid foods at separate intervals as solid foods are more readily retained.
In severe cases omit all liquid food and restrict the bulk to 100 Gm. at the time.
Select foods high in carbohydrate and low in fat.
Include vitamin concentrates, especially those of the B complex.

Foods to avoid:

All fried foods, rich gravies, sauces, or foods high in fat content. Moderate amounts of butter and cream are usually well tolerated.
All rich desserts such as pastries, rich puddings, and cake with whipped cream.
Strongly flavored vegetables or any food which is likely to cause distress.

TYPE DIET

First Day

6:00 A.M. or On Awakening	2 saltines with 1 or 2 teaspoons jelly Hard candy or loaf sugar, if desired
Breakfast	½ cup cereal with sugar Milk for cereal if desired
10:00 A.M.	2 saltines with 1 or 2 teaspoons jelly Hard candy or loaf sugar, if desired
Luncheon or Supper	½ cup broth or tomato juice 1 slice toast or 2 crackers Gelatin dessert or strained fruit
2:00 P.M.	2 crackers with 2 teaspoons jelly
Dinner	½ cup cereal with sugar Milk if desired

TYPE DIET *(Continued)*

First Day (Continued)

8:00 P.M.	2 crackers with jelly Hard candy or loaf sugar, if desired
10:00 P.M.	As at 8:00 P.M.
During the Night	If the patient awakens, give nourishment as at 8:00 P.M.

Second Day

Add 1 slice toast and 1 teaspoon jelly to breakfast and dinner

Third Day

Add strained fruit to breakfast and dinner.
Substitute baked or mashed potato for cereal at dinner.

Fourth Day

Add $\frac{1}{2}$ glass fruit juice to all nourishments.
Add strained vegetables to lunch and dinner.
If desired, substitute junket or custard for the gelatin dessert.

Fifth and Sixth Days

Gradually add the other foods allowed on a soft diet.

From the Seventh Day On

Progress gradually to the regular diet for pregnancy. As long as the patient is troubled with the feeling of nausea give particular attention to the early morning and bedtime nourishment.

Note. All additions to the previous day's diet should be made with discretion, depending on the condition of the patient. Do not progress the diet until the patient can tolerate more food.

Nephritis. The kidneys are subjected to a greatly increased strain during pregnancy. Nephritis sometimes develops and it becomes necessary to modify the diet to one containing little salt and a limited amount of fluids if edema is present. Because nutritional edema and anemia are hazards of pregnancy it becomes of first importance to supply adequate protein of the best possible quality which can be efficiently utilized for tissue building. The nitrogen of amino acids used in building cannot be of harm to the kidney for it will not be excreted as long as it remains to be used in building and repair. The caloric intake may need to be limited, at least temporarily. The following dietary measures are suggested in the treatment of nephritis in pregnancy.

SALT POOR MODERATELY LOW CALORIE DIET[6]

(For Toxemias of Pregnancy)

General rules:

Prepare all food without salt; allow no salt shaker on the tray.

The vitamin D requirements in pregnancy cannot be met by food alone; therefore the physician should prescribe cod liver oil or its equivalent.

Include these foods daily:

1 quart milk. If fluids are restricted to 1200 cc. or less allow only 1 pint of milk.

2 servings meat, fish, fowl, or cream or pot cheese

1 egg

3 teaspoons unsalted butter

1 serving whole-grain cereal or whole-grain bread

3 servings fruit—one to be orange, grapefruit, or tomato

4 servings vegetable:
- 1 to be potato
- 1 to be uncooked or tomato
- 1 to be green or yellow
- 1 as desired

Other foods to provide the requisite number of calories. Stress foods which are bulky.

Foods to avoid:

All salty foods; see list in Chapter XXXI.

All high-calorie foods; see the list in Chapter XXI.

More than 1 cup coffee and 1 cup weak tea per day

TYPE DIET

(approximately 1400 calories)

Breakfast

Fruit—fresh, or unsweetened cooked or canned
Whole-grain cereal with ½ cup milk
Egg with 1 teaspoon butter
Coffee or tea with milk and saccharin

Midmorning

Milk—1 glass

Luncheon or supper

Lean meat or cottage cheese—1 serving
Vegetable, green or yellow—1 serving
Salad with lemon juice or vinegar

TYPE DIET *(Continued)*

Luncheon or supper (Continued)

Bread—1 slice with 1 teaspoon butter
Fruit—fresh or unsweetened
Milk—1 glass

Midafternoon

Milk—1 glass

Dinner

Lean meat, fish, or fowl—1 serving (2–3 ounces)
Potato—1 small serving
Vegetable—2 servings
Fruit—fresh or unsweetened—1 serving
Tea—1 cup; saccharin may be used if desired

Evening nourishment

Milk—1 glass

Note. When fluids are limited to 1000 cc. or less the tea and coffee should be omitted.

Diabetes. Diabetes is a complication of extreme gravity in pregnancy. The increased requirements for food to meet the demands of the developing fetus must not be forgotten. It is equally important to so adjust the diet that the diabetic condition of the woman will not be aggravated. (See Chapter XXVIII, "Diabetes Mellitus.")

LACTATION

Nutritional Requirements. The nutritional demands of lactation are far greater than those of pregnancy inasmuch as the nursing mother must actually "eat for two." The average lactating woman secretes from 28 to 30 ounces of milk daily, the production of which calls not only for extra calories, but also for additional protein, minerals, and vitamins in her diet.

Protein Allowance. The mechanics of converting food protein into milk protein is only about 50 to 60 per cent efficient. It requires approximately 2 Gm. of food protein to produce 1 Gm. of milk protein. Extra protein amounting to about 0.75 Gm. per ounce of milk secreted must be allowed in the diet. An allowance of 100 Gm. daily is recommended, a large part of which should be derived from animal protein.

Energy Allowance. The normal non-pregnant woman requires about 2500 calories per day, but when she becomes a nursing mother the demands for energy are greatly increased. The Yardstick for Good Nutrition recommends 3000 calories per day while other authorities suggest 3000 to 3600 calories daily. Approximately 2300 to 2800 of the calories consumed are used for the maintenance of the woman's metabolism while about 700 calories are used in the production of 1000 cc. of milk. M. S. Rose[7] has suggested the following schedule for assuring the proper increase of calories on the part of the lactating woman:

First 3 months:	60 calories per pound of infant's body weight
3 to 6 months:	50 calories per pound of infant's body weight
6 to 9 months:	45 calories per pound of infant's body weight
9 to 12 months:	40 calories per pound of infant's body weight

Mineral Allowances. In pregnancy the bones, teeth, blood, and muscles of the fetus were being formed. After birth of the child these tissues must be maintained and additional allowances for rapid growth and development need to be provided. It is essential to increase the lactating woman's intake of calcium and iron. The increased need for other minerals will be met if the diet contains the essential amounts of protein, calcium, and iron. The following amounts of these minerals are believed to be essential in the daily diet:

Calcium	2 Gm.
Phosphorus	1.5 to 2 Gm.
Iron	15 mg.

Iodine will be supplied in adequate amounts if iodized salt is used in the preparation of foods.

Vitamin Allowances. All of the vitamins are required for growth and development. During the lactating period the mother's needs are necessarily increased since the infant will obtain an adequate share of these important factors primarily through her diet. The requirements for vitamins during the lactating period have been stated by the Food and Nutrition Committee of the National Research Council to be as follows:

Vitamin A	8000 I.U.
Thiamine (B_1)	2.0 mg.
Riboflavin (B_2)	3.0 mg.
Niacin	20 mg.
Ascorbic acid (C)	150 mg.
Vitamin D	400–800 I.U.

It is possible to meet all of the requirements for vitamins by the use of a varied diet with the exception of vitamin D which must be supplied as a supplement.

Selecting the Daily Diet. The following foods should be included daily to insure adequate nutrition for mother and nursing infant:

6 cups milk
1 large serving (4–5 ounces) meat, fish, or fowl; include liver at least once a week
2 eggs or 1 egg and a substitute of meat, cheese, fowl, or fish
6 teaspoons butter or fortified margarine
3 servings whole-grain or enriched cereals or bread
3 servings fruit—two should be citrus or tomato
4 servings vegetable—one green or yellow, one raw, one potato, and one as desired
Other foods to complete the caloric requirements in the form of rice, macaroni, spaghetti, noodles, tapioca, jam, jelly, sugar, molasses, desserts, bread

Weaning the Baby. The process of weaning is not a sudden change but as Dr. Josephine Kenyon[8] says, it is "a deliberately planned transfer. It is an adjustment from breast milk to three or four meals a day and requires a full month to accomplish." As a rule weaning begins about the fifth month, unless the physician decrees otherwise, with the omission of the 10 P.M. feeding. Dr. Kenyon suggests a very usable plan for making this adjustment, namely, for two weeks substitute two bottles or cup feedings at any convenient meal time; then add one more milk feeding and one or two breast periods for another week or two. The breast milk will gradually decrease in quantity when there are so few nursings daily. Usually after a week or ten days of this the baby will not gain so well and will show in other ways that he needs more food. Then the time has come to stop the breast feeding.

Very serious infectious diseases may make it advisable for the mother to wean the baby not only to protect him from infection

but also to spare the mother from the inevitable drain caused by nursing upon her body. Active pulmonary tuberculosis, for example, is a certain indication for weaning.

SUMMARY

1. Maternal nutrition must be considered since it affects the development of the fetus and the health of the child and of the mother. Poor nutrition may result in congenital defects and poor physical development of the child and may also lead to preeclampsia in the mother.

2. The amount of protein must be increased during pregnancy and adequate quality should be emphasized.

3. Increased amounts of minerals and vitamins are also required.

4. The need for protein, minerals, and vitamins is even further increased during lactation. The following table gives a comparison of the requirements of the normal, the pregnant, and the lactating woman:

	NORMAL	PREGNANCY (latter half)	LACTATION
Protein ....Gm.	60	85	100
Calories	2500	2500	3000
Calcium ....Gm.	0.8	1.5	2.0
Iron ....mg.	12	15	15
Vitamin A .......I.U.	5000	6000	8000
Thiamine (B_1) ....mg.	1.2	1.8	2.0
Riboflavin (B_2) ...mg.	1.6	2.5	3.0
Niacin ....mg.	12	18	20
Ascorbic acid .....mg.	70	100	150
Vitamin D .......I.U.		400–800	400–800

5. Freedom from worry, plenty of rest, relaxation, and sunshine are important factors for the mother to note.

6. The most common complications of pregnancy include excessive gain in weight, nausea and vomiting, constipation, and toxemias which may involve cardiac and kidney disorders.

7. A low calorie diet which emphasizes adequate protein, min-

erals, and vitamins is used if weight gain is too rapid. This diet should allow one quart of milk daily, unless fluids are restricted.

8. Nausea and vomiting are best controlled by using frequent feedings of easily digested high carbohydrate foods, emphasizing the early morning and the evening feedings.

9. When elevation of blood pressure, edema, or albuminuria are present the patient is given a salt-poor diet adequate in all nutritional respects, but frequently limited to 1400 calories.

PROJECTS

1. Calculate a diet for a woman which meets the optimal standards for pregnancy.
2. Plan a diet for a woman which meets the optimal standards for lactation. Calculate the food values for this diet.

REVIEW QUESTIONS

1. At what period of pregnancy is metabolism highest?
2. What are the results of poor prenatal nutrition to the mother? to the child?
3. When are the tooth buds in the fetus perceptible?
4. What nutrients are of especial importance in the formation and development of the teeth and bones in the developing infant?
5. Outline the daily dietary standards for pregnant women.
6. Why does lactation call for a greater intake of food than pregnancy?
7. What part of the daily caloric intake during lactation is required for the production of milk?
8. At what period of infancy is growth most rapid?
9. Outline the dietary standards for lactating women.
10. When does the weaning of infants begin? How long should this process usually take?
11. What are the most common complications of pregnancy?
12. What are the chief characteristics of the diet for the treatment of nausea and vomiting?
13. When is the salt-poor diet used? Why? What are the outstanding changes made in the normal diet for a salt-poor low-caloric diet?
14. What instructions would you give to a pregnant woman who complains of constipation?

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CHAPTER XV

Breast Feeding

Firm foundations for future health are laid during the first year of life. The battle may be won or lost during this period depending upon whether or not the child is properly nourished. It is well known that breast milk has been the best insurance for the maintenance of well being of the infant.

Good breast milk in sufficient quantities depends upon the diet of the mother (Chapter XIV), and since it is a natural food for babies it is well to make sure that it is good by providing the proper diet for the mother.

The secretion from the breast during the first few days after delivery is not mature milk, but a substance known as colostrum. This secretion is richer in phosphorus and sodium chloride as well as vitamin A than the milk secreted later. The infant receives only a small amount of colostrum during the first two or three days, but by the end of the first week the supply of milk will usually be great enough to satisfy the caloric needs. Many pediatricians advise supplementing the breast feeding with a formula during the first few days after the birth of the baby to overcome the loss of weight which is common at this time. A simple, easily prepared formula consists of one part of evaporated milk mixed with two parts of water and including 5 per cent cane sugar.

Intervals of Feeding. As a rule, a schedule calling for five feedings a day at 6-10 A.M. and 2-6-10 P.M. may be used from the beginning. If the baby is poorly developed the physician may advise the inclusion of a 2 A.M. feeding as well. Occasionally three-hourly feedings may be prescribed instead of the longer interval. Water should be given between feedings from a bottle or from a spoon.

Rate of Gain. The infant should be weighed once a week in the same amount of clothing each time. A steady gain of five to eight

ounces a week should be maintained during the first six months. Thereafter a gain of four ounces a week is considered normal for the second six months of life. Irregularities frequently occur in that the weight may remain stationary for a week or two. If the child fails to gain for several weeks, however, an effort should be made to determine the cause and proper measures taken to correct it.

Supplementing the Breast Feedings. Even good breast milk is not sufficient to maintain the infant in good nutrition after the first few months. Iron, ascorbic acid, and vitamin D must be supplied through the use of supplementary foods. Under average conditions orange or tomato juice is given twice daily in teaspoonful doses as early as one month or earlier. The amount of juice is gradually increased until the infant receives the juice of a whole orange at five months. Other fruits as puréed prunes, applesauce, or puréed apricots may also be given at 3 to 4 months.

Cod liver oil should be started within two weeks with a few drops given twice daily. The amount is gradually increased up to two teaspoonfuls daily by the time the infant is three months old.

Strained cereals are usually added about the third month and may be given in addition to the 10 A.M. feeding. The 2 P.M. feeding may include small amounts of puréed vegetable at 3 to 4 months.

Egg yolk is usually introduced about the fourth or fifth month. After the fifth month ground meat such as beef or liver may be alternated with the egg.

Well baked potato may be used with the 6 P.M. feeding at the beginning of the seventh month, and by the eighth month unsweetened zwieback or thoroughly dried and toasted bread may be given.

By the time the child reaches 8 months of age he should be having three meals daily and two intermediate feedings; that is, breakfast at 7 A.M., dinner at 12 noon, and supper at 5 to 5:30 P.M. with milk feedings at 10 A.M. and 3 P.M.

Weaning. The weaning process is usually started by the fifth month and never later than the ninth month (see page 192). As the breast milk decreases the baby learns to take milk from a cup — or a bottle — and by the end of the first year the baby should be able to consume the amount and type of food best calculated to cover his nutritional needs.

SUMMARY

In spite of all the advance in our scientific knowledge of human nutrition human milk still remains the ideal food for babies. While human milk is lower in calcium and protein than cow's milk (see page 199), the breast-fed infant continues to make satisfactory gains in both lineal and muscular growth. This is probably because constituents of human milk are in a form more easily utilized by the young child.

The iron content of human milk is approximately three times that of cow's milk, but neither milk contains a sufficient amount of iron to maintain a normal hemoglobin level of the blood beyond the first few months of life. Babies are born with a store of iron but supplementary iron-bearing foods are essential early in life. They should be added not later than the fourth month[1] and usually considerably earlier.

RECOMMENDED DAILY DIETARY ALLOWANCES FOR CHILDREN UNDER ONE YEAR OF AGE[2]

Calories	Protein Gm.	Calcium Gm.	Iron mg.	Vitamin A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic acid mg.	Vitamin D I.U.
100 per Kg.	3 to 4 per Kg.	1.0	6	1,500	0.4	0.6	4	30	400-800

Regular intervals of feeding are as essential for breast-fed babies as for those fed on a formula. Water should be given between feedings, from a bottle or a spoon.

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CHAPTER XVI

Artificial Feeding of Infants

There is no period in life when intelligence and care in feeding pay better dividends than during infancy. The first few years of life present many obstacles which must be met and overcome if the child is to grow and develop normally.

The most important problem of the first year is that of proper feeding. Attention and thought must be given to nutrition at this time for it must not be a haphazard or trivial matter. Even when the child has been so fortunate as to be born of a mother whose prenatal nutrition has been of the best, he stands to lose that advantage if the follow-up care is neglected.

Breast-fed babies have always been considered to have a better chance for surviving the perilous early years of life than their less fortunate artificially fed brothers; but today science has modified the situation to a great extent, and the infant who must be nourished upon a formula now has an excellent chance to grow and develop normally, provided his nutritional needs are completely covered. In order to accomplish this the formula must not only be adequate in nutritional essentials but it must be properly adjusted to his individual requirements.

The milk of each species seems especially adapted by nature to the needs of the young of that species, but since it is not always

	Fat	Sugar	Total Protein	Lactalbumin	Casein	Total Ash	Ca
Human milk . . .	3.5	7.5	1.25	.75	.50	.20	.034
Cow's milk.	3.4	4.7	3.4	.50	3.4	.75	.122

	Mg	K	Na	P	S	Cl	Fe	Cu
Human milk . . .	.005	.048	.011	.015	.036	.036	.0001	.00003
Cow's milk.	.013	.154	.060	.090	.031	.116	.00004	.00002

possible to provide human milk for the human infant, milk of another species must be used; the best substitute so far is found in properly modified cow's milk. The table[1] on page 199 is included to show the differences in percentage composition of human and cow's milk.

Goat's milk is used in some countries in infant feeding and to a certain extent it is being used in the United States. Milk of other mammals such as the water buffalo, llama, camel, and sheep is used where such milk is available.

FACTORS TO BE CONSIDERED IN ARTIFICIAL FEEDING

There are certain fundamental factors which will govern more or less the use of milk formulas such as (1) whether the infant was born at term or prematurely; (2) whether prenatal nutrition was sufficient to provide him with a sound, well developed body; (3) the nutritional needs of the individual infant; (4) the intellectual and financial status of those responsible for the care and feeding of him throughout this all-important first year.

Weight, Height, and Age. Proper weight for height and age rather than for age alone is considered to be one of the best indications for good health in all children. A steady gain in both weight and height is to be expected if the formula is providing all of the nutritional essentials. The weight and height tables available are believed by many authorities to have been estimated too low. According to Benedict and Talbot[2] "every effort may legitimately be expended to secure a maximal skeletal growth and development of children above the so-called 'average weight.' We believe that our investigations show clearly that the average weight for children is distinctly below the ideal or physiologically desirable weight."

Growth and Development. Artificially fed infants should make the same progress in growth and development as is expected of the breast-fed baby, that is, to double the birth weight in from five to six months and triple it by the end of the first year.

Nutritional Requirements. To accomplish the expected rapid development and gain in weight it is necessary to supply a sufficient amount of protein of the best biological value for the building and maintenance of the muscles and other soft tissues, enough calcium

and phosphorus for the building and calcification of the bones and teeth, iron and copper for the manufacture of the ever increasing blood stream, and sufficient other minerals and vitamins to regulate the body processes and protect against the development of deficiencies. Nutrition studies have proved that approximately 1.8 to 1.5 Gm. of protein per pound of body weight is required for building and maintenance of the tissues. About 35 calories per pound of body weight are needed simply to keep the infant alive, and, since from one quarter to one half of the food calories provided are stored to take care of growth, it will be necessary to arrange a formula which will provide the calories for the essential growth processes as well as for all of the other body activities. The following outline of food requirements should make it possible to cover the nutritional needs of the artificially fed infant throughout the first year of life.

Digestion. The digestive capacity of infants of different ages must be considered in feeding. No matter how much a baby may need extra calories, if the food furnished him cannot be handled by the digestive apparatus, the extra calories will do no good. Sixty per cent of the protein in human milk is whey protein or lactalbumin which can be completely and quickly assimilated, whereas 85 per cent of the protein in cow's milk is curd protein or casein. Human milk forms fine flocculent curds while cow's milk forms large tough curds. Cow's milk is richer in buffer substances than human milk; the buffers combine with the natural acids of the gastric juice in the stomach and Marriott[1] believes they may lower the normal acidity to a point where the digestion of protein is interfered with. Possibly the growth of bacteria is also greater, and the infant may suffer from this increased activity in the stomach and in the intestinal tract. Pediatricians, however, through practice and study have found a number of ways in which cow's milk may be made suitable for the feeding of infants whether they be full-term or premature. Dilution, heating, homogenization, and acidulation are methods used to prevent the formation of the large tough curd in milk. Dilution and heating are the most common means of preparing cow's milk to suit the digestive capacity of the body.

Planning the Formula. At least six factors must be considered in planning the formula.

DAILY REQUIREMENT OF FOOD FOR INFANTS[3]

Requirements	Age in Months	Per Pound of Body Weight	Remarks
Energy	1–4 4–7 7–12	55–50 calories 50–45 calories 45–40 calories	As a rule, an average of 50 calories per pound of body weight is allowed. If child is underweight more may have to be given. Premature babies require more calories in proportion to weight than babies born at term.
Protein	First year	1.8–1.5 Gm.	Milk protein throughout the year, adding scraped beef, or finely ground liver, beginning seventh month.
Fat	First year		If 1.5 oz. of cow's milk is allowed per pound of body weight, the fat will be supplied in sufficient amounts.
Carbohydrates, as sugar	First year	5 Gm.	1.5 oz. of cow's milk will furnish approximately 2 Gm. of sugar. This is not sufficient, so 3 Gm. of sugar must be added to bring the amount up to 5 Gm. per pound of body weight.
As Starch in form of cooked cereal			If carbohydrate allowance exceeds 1.5 oz. daily, cereal water may be used.
Mineral salts	First three months	1.5 oz. of cow's milk will furnish necessary calcium and phosphorus	It is necessary to supplement the milk formula with fruit and vegetable juices after the first month, beginning with 1 tsp. and increasing to 4 tbsp. by end of first year for essential iron.
Water	First year	1.5–2.5 oz.	The average bottle-fed baby of 4 months will take one quart of milk mixture per day.
Vitamins			Diluted orange or tomato juice may be given when baby is 7 days. After third month, strained vegetable juices or pulp may be added, allowing 1 tsp. twice daily plus 1 oz. of water in which vegetable was cooked. This will increase vitamin content. Munsell[4] suggests an intake of from 135 to 400 I.U. of vitamin D per day per child when in the form of milk and at least 600 I.U. when vitamin D is given in any other form.

1. The type of milk to be used is important. Not only must it be selected to suit the individual infant, but it must be of the type most available, and require the least effort to prepare. Fresh whole milk, plain or irradiated evaporated milk, dried milk, or soured milk each has its uses.

Evaporated milk is especially suited to infant feeding since it requires no refrigeration until the can is opened, it is sterile, it produces a very fine curd in the stomach, and it is of uniform composition.

Dried milk is also used in the making of infant formulas, especially in localities where fluid milk is not available. It is in portable form; it may be obtained in whole, skimmed or protein milk; it is readily digested by the average infant and it does not require refrigeration. By correct dilution it may approximate whole sweet milk, or it may be prepared in a more concentrated form for infants with limited stomach capacity; whole dried milk (Klim) has a caloric value of 145 calories per ounce ($4\frac{1}{2}$ tablespoons equal 1 ounce).

Acid milk formulas which may be prepared with whole fresh or evaporated milk are occasionally prescribed by the physicians. Certain advantages are claimed for these formulas: (1) the production of a fine curd with the acid renders the protein more easily digestible; (2) no dilution is required so there is less danger of the infant becoming undernourished because of inability to tolerate large quantities of milk; (3) the bacterial content of acid milk is lower; (4) there is less tendency for infants receiving these formulas to vomit.

2. The amount of milk needed daily has been found to be about 1.5 to 2 ounces or an average of 1.75 ounces per pound of body weight.

3. The sugar selected should be inexpensive and easily digested. Cane sugar and Karo syrup lend themselves most easily to formula preparation, although there are cases in which the use of other sugars such as dextri-maltose 1-2-3 are sometimes recommended by the physician. During the first year the amount of sugar required is about 1 part for each 10 to 15 parts of milk. As other foods containing starch are added to the infant's diet the amount of sugar in the formula is gradually decreased.

4. The amount of fluid required daily is about $\frac{1}{10}$ of the infant's body weight or 1.5 to 2.5 ounces per pound of body weight. A baby will usually take 2-3 ounces more of fluid at a single feeding than his age in months. More than 7 ounces at one feeding is usually undesirable before the infant is seven months old. No increases in fluid should be made when a single feeding contains 8 ounces since the infant will then be taking other foods as well. The amount of water given daily will then be the difference between the total fluid requirement and the amount of milk used in the formula.

5. The number of feedings in 24 hours varies. As a rule feedings at 4 hour intervals are most satisfactory. These hours may be 6-10 A.M. and 2-6-10 P.M. During the first weeks of life a 2 A.M. feeding may be needed especially if the infant is not well nourished. Some physicians suggest that feedings be given at 6 and 10 A.M. and 1, 4, 7, and 11 P.M. thus including six feedings without the necessity of a 2 A.M. feeding. Artificially fed infants should not be fed too frequently since cow's milk remains for a longer time in the stomach than breast milk. When the intervals between feedings are too short, both the baby's appetite and digestion are likely to be affected.

6. The method of preparation must be one which requires simple equipment, a minimum of time, and produces a formula which contains no pathogenic organisms. The usual equipment includes a large covered pot in which bottles may be sterilized, a jar with cover for nipples, a graduate or measuring cup, a mixing spoon, measuring spoons, a sauce pan for preparation of the formula, funnel, bottles, bottle caps, and nipples.

The type of formula used depends upon the prescription of the doctor. Standard milk formulas which approximate breast milk in caloric value (20 calories per ounce) are:

Fresh whole milk formula		*Evaporated milk formula*	
Whole milk	2 parts	Evaporated milk	1 part
Water	1 part	Water	2 parts
Sugar	5 per cent	Sugar	5 per cent

The following schedules are included to facilitate the use of whole sweet milk or evaporated milk in the feeding of infants:

SCHEDULE FOR FEEDING NORMAL INFANTS WITH WHOLE SWEET MILK MIXTURES[1]

Age months	Whole Milk ounces	Water ounces	Sugar ounces	Feedings Number	Feedings Amount ounces
½	11	7	1	6	3
1	14	10	1	6	4
2	18	12	1¼	5	6
3	21	9	1½	5	6
4	25	10	1¾	5	7
6	28	7	2	5	7
8	32	..	..	4	8
12	32	..	..	4	8

SCHEDULE FOR USING EVAPORATED MILK IN INFANT FORMULAS[1]

Age months	Evaporated Milk ounces	Water ounces	Sugar ounces	Feedings Number	Feedings Amount ounces
½	5	13	1	6	3
1	6½	17½	1	6	4
2	8	22	1¼	5	6
3	10	20	1½	5	6
4	12	23	1¾	5	7
6	13	22	2	5	7
8	15	20	1½	5	7
12	15	17	..	4	8

PREPARATION OF THE FORMULA

Method of Preparing Whole Milk Formulas. All of the utensils used in making up the formula must be scrupulously clean and within easy reach. Bottles, nipples, and caps should be thoroughly washed with soapy water after which they are well rinsed. If bottles require preliminary sterilization as in method 1 below, place them in a rack which fits into a large pot or can. Allow 1 to 2 inches of water in the pot, cover tightly, and allow to boil for one minute after the steam begins to escape in appreciable amounts.

The sugar is measured carefully and dissolved in the amount of water required for the formula. In most households a tablespoon may be most convenient for measuring the sugar. Fill the spoon and level off with a knife. The number of tablespoons of various types of sugar to use for one ounce is given on page 206.

VOLUME OF SUGAR IN ONE OUNCE

Cane sugar	2 tablespoons
Karo syrup	2 tablespoons
Glucose (cerelose)	3 tablespoons
Lactose	3 tablespoons
Dextri-maltose	4 tablespoons

The milk bottle should be inverted several times to assure uniform mixture before the milk is measured. Wipe the mouth clean with a damp cloth before the cap is removed. The exact amount of milk is then added to the water and sugar solution and mixed. Either of the following methods is adequate for producing a formula which not only will yield a small curd in the stomach but is also bacteriologically safe.

1. Boil milk mixture for three minutes and pour the required amount into hot sterilized bottles. Put a nipple on each bottle being careful not to touch the part which goes into the baby's mouth. Cover with a glass or metal cap, cool bottles rapidly in running water, and store in a refrigerator until needed.

2. Measure the exact number of ounces required for each feeding directly into bottles and cover with nipples. Place the bottles in a rack designed for the purpose, lower the rack in a pot or can containing three or four inches of water, cover closely, and boil for 15 minutes or more — according to the directions of the physician. After the pasteurizing process has been completed cool the bottles under running water and place in the refrigerator.

Preparation of Formulas with Evaporated Milk. Evaporated milk may be substituted for cow's milk if it is properly diluted. For example, if a formula calls for 20 ounces fresh cow's milk, 10 ounces water, and 2 ounces sugar, one could substitute by using 10 ounces evaporated milk, 20 ounces water, and 2 ounces sugar. This formula is of very slightly higher caloric value than the fresh milk formula; however, infants seem to be able to tolerate more evaporated milk than fresh milk without overstepping the digestive capacity.

Preparation of Acid Milk Formulas. Acid milk is prepared from fresh cow's milk by adding 1½ fluid drams (6 cc.) of 85 per cent U.S.P. lactic acid to 1 quart milk which has been boiled and

cooled. From 4 to 5 drops are sufficient for one ounce of milk. The acid must be added slowly, drop by drop, with constant stirring. The necessary amount of sugar is then mixed with the acid milk. No further heating or dilution is necessary.

A convenient way to make a formula with evaporated milk is to use a stock acid-sugar solution which is prepared by boiling 5 tablespoons sugar in 1 pint water, cooling the mixture, and adding 1 teaspoon lactic acid. This stock solution can be kept for several days in the refrigerator.

The formula is mixed by using 1 part acid-sugar solution, 1 part evaporated milk, and 1 part water. For infants over 3 months of age it is possible to omit the water thus feeding a more concentrated mixture.

FEEDING THE BABY

The bottles should be warmed to body temperature by immersing them in warm water before the feeding is given to the baby. The temperature of the milk is tested by allowing a few drops to fall on the inner side of the wrist. If the milk is of the proper temperature it cannot be felt on the arm. As a rule, a normal infant if hungry will take all he needs in ten to fifteen minutes. The hole in the nipple should not be too large, since the rapid taking of the formula together with the swallowing of a lot of air will cause discomfort. On the other hand a very small hole in the nipple will necessitate an overly long period of feeding.

Foods in addition to the formula are begun as early as two weeks of age. The following is a meal plan which is suitable for infants under 10 months of age. The age at which the various foods are added to the baby's diet is indicated in parentheses.

REGULAR DIET FOR INFANTS UNDER 10 MONTHS OF AGE[5]

TYPE DIET

6:00 A.M.	Formula
8:00	Orange or tomato juice (1 week)
10:00	Cereal ($2\frac{1}{2}$ to 3 months) Formula

REGULAR DIET FOR INFANTS UNDER 10 MONTHS OF AGE *(Continued)*

TYPE DIET *(Continued)*

2:00 P.M.	Strained vegetable (3 to 4 months)
	Egg yolk—hard cooked ($3\frac{1}{2}$ to 4 months)
	Ground meat or liver (alternate with egg yolk after 5 months)
	Potato (6 months)
	Strained fruit or ripe banana (3 to 4 months) or soft pudding (6 months)
	Formula
6:00	Cereal ($2\frac{1}{2}$ to 3 months)
	Strained fruit (3 to 4 months)
	Formula
10:00	Formula
	As soon as indicated:
	1. Give 4 feedings (omitting the 10:00 P.M. formula)
	2. Give infant three meals using foods designated above. Meal times may be the same as for infants from 10 months to 18 months.

Vitamins A and D to be added (5 days)

Good food habits should be established during the first year of life.

When vegetable or fruit pulp, egg yolk or scraped meat are to be added to the diet it is advisable to start with a very small portion of permitted food, and increase the quantity and variety until the habit of eating different foods is well established.

FEEDING OF PREMATURE INFANTS

Infants who are born prematurely suffer a handicap which must be overcome if they are to grow and develop normally. Deprivation of the expected prenatal nutrition results in an infant who is more or less underdeveloped; the digestive capacity is distinctly limited. The following points require careful consideration:

1. The degree of prematurity, 6-7-8 months.

2. The physical strength and condition of the infant; frequently a premature infant is too feeble to nurse and must be fed by means of a Breck feeder.

3. Since the digestive system is more or less underdeveloped the nourishment must be adjusted both in type and amount; the majority of infants born prematurely have a relatively greater tolerance for carbohydrates than protein and fat.

4. The availability of human milk.

5. The use of evaporated milk as the best substitute for breast milk when the latter is not available.

Nutritional Requirements. Premature infants are likely to be small and thin, and since there is relatively greater loss of heat in small bodies than in larger ones the premature baby will need more calories per pound of body weight per day than an infant born at term; 60 to 100 calories per pound of body weight per day is considered sufficient.

Protein: The amount of protein equivalent to 1½ to 3 ounces of breast milk per pound of body weight per day is adequate.

Feeding Procedures.[6] First 12 hours: ½ to 1 ounce of a 5 per cent solution of cane sugar is administered by bottle if the infant is strong enough to suck; otherwise the sugar solution is given from a feeder or medicine dropper.

Second 12 hours: 1 to 3 feedings of breast milk. After the first day the baby should be placed at the breast for two or three minutes, at three hour intervals. Small amounts of water are given from the feeder several times a day, between the milk feedings. Very small babies cannot be fed by the above method, but may be given from ¼ to ½ ounce of breast milk diluted one half at first. This may be increased gradually until at the end of from one to two weeks a three pound infant will be receiving from 1 to 1½ ounces of breast milk and water every three hours; the water in the formula is to be gradually decreased as the milk is increased. When the food equals one sixth of the body weight very little extra water will be necessary.

Three hour intervals throughout the 24 hour period are usually most successful for feeding the premature infant.

When evaporated milk is substituted for breast milk the Standard Formula on page 204 is diluted one half. The water is gradually reduced until the original formula is being given.

COMPOSITION OF VARIOUS FOODS USED IN THE PREPARATION OF INFANT FORMULAS[5]

Food	Percentage			Calories			Tbsp. per oz.	Grams per Tbsp.
	Cho.	Prot.	Fat	Oz.	CC.	Gm.		
Milk								
Breast milk	7.5	1	4	20	0.7	—	—	—
Whole milk	5.0	3.5	4	20	0.7	—	—	—
Evaporated milk	10.0	7.0	8	44	1.4	—	—	—
Skimmed milk	5.0	3.5	0.5	10	0.4	—	—	—
Half skimmed milk	5.0	3.5	2.0	15	0.5	—	—	—
Buttermilk	5.0	3.5	0.5	10	0.4	—	—	—
Dried Milk								
Dryco	47	32	12	119	—	4.2	5	6
Hi-Pro	35	41	14	121	—	4.3	4	7.5
Klim	38	27	28	145	—	5.1	3.5	8.5
Lactogen	53	16	25	143	—	5.0	4.0	7.5
Olac	53	23	19	134	—	4.8	3.5	8.5
Protein Milk	24	37	27	144	—	5.0	3.5	8.5
Similac	54	12	27	145	—	5.1	3.5	8.5
S.M.A.	59	10	28	151	—	5.3	3.5	8.5
Sugars								
Cane Sugar	100	—	—	114	—	4.0	2.0	15.0
Dexin	99	—	—	112	—	3.9	6.0	5.0
Dextro-Maltose	97	—	—	110	—	3.9	4.0	7.5
Honey	80	—	—	91	—	3.2	1.5	20.0
Glucose (Cerelose)	90	—	—	102	—	3.6	3.0	10.0
Karo	74	—	—	85	—	3.0	2.0	15.0
Lactose	100	—	—	114	—	4.0	3.0	10.0
Cereals								
Barley Flour	77	10	2	105	—	3.7	3.5	8.5
Farina	76	12	1	102	—	3.6	3.0	10.0
Pablum	70	15	3	106	—	3.7	12.0	2.5
Oatmeal, dry	68	14	7	111	—	3.9	5.0	6.0
Allergy								
Goat's milk (fresh)	5	3	4	20	0.7	—	—	—
Goat's milk (evap.)	8	8	7	37	1.3	—	—	—
Mul-soy	9	6	8	40	1.3	—	—	—
Sobee (powder)	37	32	19	128	—	4.5	6	5.0
Miscellaneous								
Banana powder	85	5	2	105	—	3.7	3.5	8.5
Casec	—	88	2	105	—	3.7	7.0	4.3
Nutramigen	55	20	18	132	—	4.7	3.5	8.5

Analyses are taken from Accepted Foods of the American Medical Association or of the U. S. Department of Agriculture Circular 549 ("Proximate Composition of American Food Products"); or from the Manufacturer's Research Departments

SUMMARY

Not all infants are privileged to be fed on their natural food — human milk. However, if the prenatal nutrition has been good the baby can develop and grow satisfactorily if the artificial formula is suited to his age and physical condition.

The composition of cow's milk, which is the logical substitute for human milk, differs in several respects from that of human milk. It contains a higher percentage of protein and calcium, but a much lower iron content. Infants are born with a storage of iron on hand, but this store will not maintain a normal hemoglobin level of the blood unless it is supplemented with iron-bearing foods when the infant is three months of age or earlier.

RECOMMENDED DIETARY ALLOWANCES FOR INFANTS UNDER 1 YEAR OF AGE[7]

Nutrients	Per Pound of Body Weight	Per Day
Protein	$1\frac{1}{2}$ to 2 grams	
Calories	55 to 50	
Calcium		1 gram
Iron		6 milligrams
Vitamin A		1500 I.U.
Thiamine (B_1)		0.4 milligrams
Riboflavin (B_2)		0.6 milligrams
Nicotinic acid		4.0 milligrams
Ascorbic acid (C)		30.0 milligrams
Vitamin D		400-800 I.U.

These points must be considered in planning the formula for the infant:

1. Type of milk to be used — fresh cow's milk, evaporated milk, dried milk, or acid milk.

2. Type of sugar to be used — cane sugar, Karo syrup, dextrimaltose, lactose.

3. Number of feedings and intervals for feedings, the four hour feedings being preferable.

4. Dilute orange juice to be given as a supplement beginning with the seventh day. By the time the infant is 3 months old he should be getting at least one ounce of pure orange juice.

5. Other supplementary foods are added at the third month, including cereals and strained vegetables. Egg yolk and ground meat are given at 5 months.

6. Good food habits must be established during the first year if they are to become fixed thereafter.

Premature infants must take very dilute formulas during the early weeks of life. They are particularly susceptible to rickets probably due to the low calcium content of their bodies at birth together with their inability to take enough milk at the beginning of life to make up for the deficiency.

PROJECTS

1. Calculate a formula for an infant of four months of age who weighs twelve pounds.
2. Outline the day's diet for an infant of seven months. Include calculations for the formula.

REVIEW QUESTIONS

1. Outline the daily nutritional standards for artificially fed infants during the first year of life.
2. What types of milk are used in the preparation of formulas?
3. What types of sugar are used to supplement the carbohydrate content of milk in preparation of formulas?
4. At what age is cod liver oil added to the diet of artificially fed infants? When is orange or tomato juice added?
5. How would you proceed to make up a formula from fresh milk, and one from evaporated milk that would approximate the caloric value of breast milk?
6. Give temperature for pasteurization. At what temperature is the tuberculosis bacteria destroyed?
7. State the effect of pasteurization and of sterilization upon milk.
8. What is the difference between fluid cow's milk and irradiated evaporated milk?
9. Give the age of the infant at which cereals are added to the diet.
10. At what age may fruit pulp be added? Vegetable pulp?
11. When is it advisable to add egg yolk to the diet of infants? What food may be used as an alternate for egg yolk, and when may it be added to the diet?
12. Outline the difference in the feeding procedures for normal and for premature infants. Give reasons for the differences.

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CHAPTER XVII

Feeding of Older Children

The problem of maintaining a child in good nutrition is a vital one. The period from birth to maturity represents one of progressive growth and development, and calls for the closest attention to the food intake in order that all of the essential nutrients may be adequately provided. The observance of those general dietary rules which were considered necessary for pregnant and lactating women and for feeding infants under one year of age should be continued throughout the period of childhood. The feeding of the preschool child, the school child, and the adolescent boy and girl is equally as important as that of the infant or the adult. No relaxing of effort is possible if the individual is to grow and develop normally.

Malnutrition is no respecter of age but children seem to be more susceptible to its development than adults, and therefore must be doubly protected from both the recognized symptoms of dietary deficiencies and from those hidden hungers which may occur when one or more of the nutritional essentials is omitted. Good nutrition depends not only upon the character and amounts of food offered, but also upon the ability of the child to handle it.

There are a number of factors to consider in the feeding of children, among the most important of which are: (1) weight in relation to height and age as well as for height and build; (2) the average growth rate of children of different ages, and the weekly gain in terms of ounces and pounds; (3) daily dietary essentials for children over one year of age, and the foods which will provide them; (4) the pattern or type diets which are suitable for children of various ages; and finally (5) food habits and allergies.

Measurement of Growth. The following tables have been found to be satisfactory for calculating the needs for energy and protein of average healthy children.

WEIGHT-HEIGHT-AGE TABLE FOR BOYS FROM BIRTH TO SCHOOL AGE *

Height (Inches)	Average Weight for Height (Pounds)	1 Mo.	3 Mos.	6 Mos.	9 Mos.	12 Mos.	18 Mos.	24 Mos.	30 Mos.	36 Mos.	48 Mos.	60 Mos.	72 Mos.
20	8	8											
21	9½	9	10										
22	10½	10	11										
23	12	11	12	13									
24	13½	12	13	14									
25	15	13	14	15	16								
26	16½		15	17	17	18							
27	18		16	18	18	19							
28	19½			19	19	20	20						
29	20½			20	21	21	21						
30	22			22	22	22	22	22					
31	23				23	23	23	23	24				
32	24½				24	24	24	25	25				
33	26					26	26	26	26	26			
34	27						27	27	27	27			
35	29½						29	29	29	29	29		
36	31							30	31	31	31		
37	32							32	32	32	32	32	
38	33½								33	33	33	34	
39	35								35	35	35	35	
40	36½									36	36	36	36
41	38										38	38	38
42	39½										39	39	39
43	41½										41	41	41
44	43½											43	43
45	45½											45	45
46	48												48
47	50												50
48	52½												52
49	55												55

Notes. 1. Weight is stated to the nearest pound; height to the nearest inch, age to the nearest birthday.

2. Up to and including 34 inches the *weights are net*. Above this the following amounts have been added for clothing (shoes and sweaters are not included): 35 to 39 in., 1¼ lbs.; 40 to 44 in., 1½ lbs.; 45 to 49 in., 1¾ lbs.

* Taken from Tables arranged by Woodbury, Robert M., Children's Bureau, U. S. Dept. of Labor.

HEIGHT AND WEIGHT TABLE FOR BOYS *

Height Inches	5 Yrs.	6 Yrs.	7 Yrs.	8 Yrs.	9 Yrs.	10 Yrs.	11 Yrs.	12 Yrs.	13 Yrs.	14 Yrs.	15 Yrs.	16 Yrs.	17 Yrs.	18 Yrs.
39	35	36	37											
40	37	38	39											
41	39	40	41											
42	41	42	43	44										
43	43	44	45	46										
44	45	46	46	47										
45	47	47	48	48	49									
46	48	49	50	50	51									
47		51	52	52	53	54								
48		53	54	55	55	56	57							
49		55	56	57	58	58	59							
50			58	59	60	60	61	62						
51			60	61	62	63	64	65						
52			62	63	64	65	67	68						
53				66	67	68	69	70	71					
54				69	70	71	72	73	74					
55					73	74	75	76	77	78				
56					77	78	79	80	81	82				
57						81	82	83	84	85	86			
58						84	85	86	87	88	90	91		
59						87	88	89	90	92	94	96	97	
60						91	92	93	94	97	99	101	102	
61							95	97	99	102	104	106	108	110
62							100	102	104	106	109	111	113	116
63							105	107	109	111	114	115	117	119
64								113	115	117	118	119	120	122
65									120	122	123	124	125	126
66									125	126	127	128	129	130
67									130	130	132	133	134	135
68									134	135	136	137	138	139
69									138	139	140	141	142	143
70										142	144	145	146	147
71										147	149	150	151	152
72										152	154	155	156	157
73										157	159	160	161	162
74										162	164	165	166	167
75											169	170	171	172
76											174	175	176	177

* Prepared by Dr. Thomas D. Wood and published by the American Child Health Association.

Measurements are taken in indoor clothes without shoes, sweaters, or coats. Age is taken at nearest birthday, height at nearest inch, and weight at nearest pound. Courtesy of Child Health Organization of America.

WEIGHT-HEIGHT-AGE TABLE FOR GIRLS FROM BIRTH TO SCHOOL AGE *

Height (Inches)	Average Weight for Height (Pounds)	1 Mo.	3 Mos.	6 Mos.	9 Mos.	12 Mos.	18 Mos.	24 Mos.	30 Mos.	36 Mos.	48 Mos.	60 Mos.	72 Mos.
20	8	8											
21	9	9	10										
22	10½	10	11										
23	12	11	12	13									
24	13½	12	13	14	14								
25	15	13	14	15	15								
26	16½		15	16	17	17							
27	17½		16	17	18	18							
28	19			18	19	19	19						
29	20			19	20	20	20						
30	21½			21	21	21	21	21					
31	22½				22	22	23	23	23				
32	24					23	24	24	24	25			
33	25						25	25	25	26			
34	26½						26	26	26	27			
35	29						29	29	29	29	29		
36	30							30	30	30	30	31	
37	31½							31	31	31	31	32	
38	32½								33	33	33	33	
39	34								34	34	34	34	34
40	35½									35	36	36	36
41	37½										37	37	37
42	39										39	39	39
43	41										40	41	41
44	42½											42	42
45	45												45
46	47½												47
47	50												50
48	52½												52

NOTES. 1. Weight is stated to the nearest pound; height to the nearest inch, age to the nearest month.

2. Up to and including 34 inches the *weights are net.* Above this the following amounts have been added for clothing (shoes and sweaters are not included): 35 to 39 in., 1 lb.; 40 to 44 in., 1½ lbs.; 45 to 49 in., 1¾ lbs.

* Tables arranged by Woodbury, Robert M., Children's Bureau, U. S. Dept. of Labor.

HEIGHT AND WEIGHT TABLE FOR GIRLS *

Height, Inches	5 Yrs.	6 Yrs.	7 Yrs.	8 Yrs.	9 Yrs.	10 Yrs.	11 Yrs.	12 Yrs.	13 Yrs.	14 Yrs.	15 Yrs.	16 Yrs.	17 Yrs.	18 Yrs.
39	34	35	36											
40	36	37	38											
41	38	39	40											
42	40	41	42	43										
43	42	42	43	44										
44	44	45	45	46										
45	46	47	47	48	49									
46	48	48	49	50	51									
47		49	50	51	52	53								
48		51	52	53	54	55	56							
49		53	54	55	56	57	58							
50			56	57	58	59	60	61						
51			59	60	61	62	63	64						
52			62	63	64	65	66	67						
53				66	67	68	68	69	70					
54				68	69	70	71	72	73					
55					72	73	74	75	76	77				
56					76	77	78	79	80	81				
57						81	82	83	84	85	86			
58						85	86	87	88	89	90	91		
59						89	90	91	93	94	95	96	98	
60							94	95	97	99	100	102	104	106
61							99	101	102	104	106	108	109	111
62							104	106	107	109	111	113	114	115
63							109	111	112	113	115	117	118	119
64								115	117	118	119	120	121	122
65								117	119	120	122	123	124	125
66								119	121	122	124	126	127	128
67									124	126	127	128	129	130
68									126	128	130	132	133	134
69									129	131	133	135	136	137
70										134	136	138	139	140
71										138	140	142	143	144
72											145	147	148	149

* Prepared by Dr. Thomas D. Wood and published by the American Child Health Association.

Measurements are taken in indoor clothes without shoes, sweaters, or coats Age is taken at nearest birthday; height at nearest inch; and weight at nearest pound. Courtesy of Child Health Organization of America.

RATE OF GROWTH FOR BOYS OF DIFFERENT BUILDS DURING SCHOOL AGE *

AGE—YEAR	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Av. Height (in.)														
Short	43	45	47	49	51	53	54	56	58	60	62	64	65	65
Medium	46	48	50	52	54	56	58	60	63	65	67	68	69	69
Tall	49	51	53	55	57	59	61	64	67	70	72	72	73	73

* Taken from the Baldwin-Wood *Weight-Height-Age Tables for Boys and Girls of School Age*, published by the American Child Health Association.

NORMAL WEEKLY AND YEARLY GAIN IN OUNCES AND POUNDS OF CHILDREN FROM BIRTH TO MATURITY *

AGE OF BOYS	GAIN	
	Ounces per Wk.	Pounds per Yr.
First year	3½ to 4½	11 to 13
Second year	2½ to 3	8 to 9¾
Third year	1½ to 2	4¾ to 6½
Fourth to eighth (inclusive)	1¼ to 1½	4 to 5
Ninth to eleventh (inclusive)	1¾ to 2	5⅔ to 6½
Twelfth to thirteenth (inclusive)	2¾ to 3	9 to 9¾
Fourteenth to sixteenth (inclusive)	3 to 4	9¾ to 13

* Prepared for New York Association for Improvement of Conditions for the Poor by Lucy Gillett.

RATE OF GROWTH FOR GIRLS OF DIFFERENT BUILDS DURING SCHOOL AGE *

AGE—YEAR	6	7	8	9	10	11	12	13	14	15	16	17	18
Av. Height (in.)													
Short	43	45	47	49	50	52	54	57	59	60	61	61	61
Medium	45	47	50	52	54	56	58	60	62	63	64	64	64
Tall	47	50	53	55	57	59	62	64	66	66	67	67	67

* Taken from the Baldwin-Wood *Weight-Height-Age Tables for Boys and Girls of School Age*, published by the American Child Health Association.

NORMAL WEEKLY AND YEARLY GAIN IN OUNCES AND POUNDS OF CHILDREN FROM BIRTH TO MATURITY *

Age of Girls	Gain	
	Ounces per Wk.	Pounds per Yr.
First year	3½ to 4½	11 to 13
Second year	2½ to 3	8 to 9¾
Third year	1¾ to 2	5⅔ to 6½
Fourth to eighth	1¼ to 1½	4 to 5
Ninth to twelfth	1¾ to 2¼	5¾ to 7
Thirteenth to fifteenth	2¾ to 3¼	9 to 10½
Sixteenth to seventeenth	1 to 2	3¼ to 6½

* Prepared for New York Association for Improvement of Conditions for the Poor, by Lucy Gillett.

Age is not the sole factor on which to base the ideal weight for children. Weight in relation to height and age gives a truer measure. Some authorities consider the weight figures in use today to be too low, and that all children should be given an opportunity for making better gains through an increased food intake.

Daily Dietary Allowances. *Protein.* Since childhood represents the period of growth, and protein is the chief essential for growth, it is important to provide this nutrient not only in sufficient quantities but also of the best biological quality. The allowances recommended by the Food and Nutrition Committee of the National Research Council[1] for healthy children are sufficiently liberal.

Milk is one of the most important sources of growth protein. A quart of milk a day provides the protein needs of young children, and about half of the protein requirement at the beginning of adolescence. Additional sources of excellent protein are eggs and lean meats, while legumes (especially soy beans) and wheat products provide good supplementary protein.

Energy. The approximate daily caloric requirement for children is listed in the table of food allowances recommended by the National Research Council (page 223). The caloric needs for

a child should be based upon the expected weight for his height rather than upon his actual weight. Such calculations will come more nearly within the needs of the very fat or the very thin child. In order to determine the caloric allowances for the individual child, making use of the Height-Weight-Age tables, the following table showing the number of calories per kilogram and per pound of body weight is included.

TOTAL CALORIES FOR CHILDREN IN TERMS OF BODY WEIGHT*

Age in Years	Cals. per Kg. per Day		Cals. per Lb. per Day	
Under 1 year	100		45	
1–3	100–96		45–44	
4–6	92–84		42–38	
7–9	80–75		36–34	
10–12	73–69		33–31	
	BOYS	GIRLS	BOYS	GIRLS
13–15	68–66	63–52	31–30	29–24
16–20[a]				
Very active	78	54	35	25
Moderately active	59	43	27	20
Inactive	39	37	18	17

[a]Based on average weight for age and the energy allowances recommended by the Food and Nutrition Board of the National Research Council of the United States of America as given in the table on page 223.

*MacLeod, G. and Taylor, C. M.: *Rose's Foundations of Nutrition,* 4th ed., New York: The Macmillan Company, 1944.

Minerals. Calcium is the mineral standing in greatest need of attention in the diet of children, since other essential minerals are more likely to be provided in the average diet. Milk is conceded to be the best source of calcium. To supply the amount of calcium essential for growing children 1½ pints to 1 quart of milk daily for children up to ten years of age is necessary, with a quart daily being preferable. During adolescence it is essential to include a quart of milk in the daily diet, not only because growth is accelerated at this time but also because dental caries are more numerous during this period.

The requirement for iron varies greatly for children of different ages. Growth calls for a large supply of this mineral for the manufacture of hemoglobin. As the volume of blood increases so also must the hemoglobin increase. The major portion of iron is to be found in the circulating hemoglobin. When the iron is deficient

the production of hemoglobin is interfered with and iron deficiency anemias are likely to occur.

Vitamins. Vitamin A or its precursor carotene is found in a number of foods such as milk, cheese, eggs, green and yellow vegetables, and liver (see Chapter VII) which makes it possible to furnish the amount considered necessary without too much effort. In fact, any reasonably good diet should supply not only a sufficient amount for growth in children but for storage as well. There is clinical evidence to show that vitamin A deficiency is dependent to a greater measure upon a defect in utilization than to dietary deficiency.

Vitamin B_1 or thiamin is not always furnished in adequate amounts for optimum nutrition in the diet of children. This is often due to the fact that highly refined cereals and flours are used instead of whole-grain products. This is especially likely to occur with families of low income when the major part of the caloric intake is derived from cereal and sugar products which yield calories but lack other nutritional essentials. Active growth increases the need for thiamine, while fevers and certain other pathological conditions also necessitate a much larger intake.

If the diet contains the recommended amount of milk daily the greater part of the necessary riboflavin will be furnished. Other good sources of this vitamin are meat, especially lean pork, and glandular organs such as liver and kidney.

The inclusion of a variety of foods — lean meat, eggs, green leafy vegetables, milk, whole-grain cereals — assures an adequate source of niacin as well as of the other B vitamins.

Because of their content of ascorbic acid, orange juice and tomato juice have been recommended in the diet of infants and children until their use has become practically a routine measure. It should be remembered that grapefruit juice, too, whether fresh or canned, is an equally good source of this vitamin. While fruits are included in most diets, investigations have shown that the amounts taken are not always sufficient to cover the needs of the active child.

The amount of vitamin D to be found in food is limited. Unless fish liver oils or their equivalent in concentrates are included daily for children, the average intakes are likely to be deficient.

RECOMMENDED DIETARY ALLOWANCES FOR CHILDREN OF DIFFERENT AGES *

Children up to 12 years	Calories	Protein Gm.	Calcium Gm.	Iron mg.	Vitamin A *** I.U.	Thiamine ** mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid ** mg.	Vitamin D I.U.
1—3 years	1200	40	1.0	7	2000	0.6	0.9	6	35	400
4—6 years	1600	50	1.0	8	2500	0.8	1.2	8	50	400
7—9 years	2000	60	1.0	10	3500	1.0	1.5	10	60	400
10—12 years	2500	70	1.2	12	4500	1.2	1.8	12	75	400
Children over 12 years										
Girls, 13—15 years	2600	80	1.3	15	5000	1.3	2.0	13	80	400
16—20 years	2400	75	1.0	15	5000	1.2	1.8	12	80	400
Boys, 13—15 years	3200	85	1.4	15	5000	1.5	2.0	15	90	400
16—20 years	3800	100	1.4	15	6000	1.8	2.5	18	100	400

* Recommended by the Food and Nutrition Committee of the National Research Council.

** 1 mg. thiamine equals 333 I.U.; 1 mg. ascorbic acid equals 20 I.U.

*** Requirements may be less if provided as vitamin A; greater if provided chiefly as the provitamin carotene.

Allowances are based on needs for the middle year in each group and for moderate activity.

Further Recommendations, Adopted 1942:

The requirement for iodine is small; probably about 0.002 to 0.004 milligram a day for each kilogram of body weight. This need is easily met by the regular use of iodized salt; its use is especially important in adolescence.

The tentative standards for calculating the dietary needs for children established by the Food and Nutrition Committee of the National Research Council are listed on page 223.

Planning the Daily Diet. The following foods should be included daily in the diet of the young child:

1½ pints to 1 quart milk
1 egg; at least 4 each week. On the days when eggs may not be used, substitute cheese, more milk, meat, nuts, or legumes
1 serving meat, fish, or poultry
1 potato
2 vegetables; one should be green or yellow
2 fruits; one should be citrus or tomato
2 servings whole-grain or enriched cereal or bread
1 to 3 teaspoons butter; larger amounts for older children
Cod liver oil or other concentrate of vitamin D
Other foods as required to fill the caloric requirement

These type diets may be used as a guide in feeding children of various ages. Satisfactory rates of growth are the final guide in determination of the adequacy of the diet.

REGULAR DIET FOR CHILDREN FROM 10 MONTHS TO 18 MONTHS OF AGE[2]

Breakfast

Orange or tomato juice
Whole-grain or enriched cereal *or* 1 egg
Toast, zwieback, or graham crackers
Milk

Dinner

Ground meat or poultry
Potato
Finely chopped vegetables*
Dessert: soft pudding, custard, junket, or gelatin
Milk

Supper

Milk toast, milk soup, cream or cottage cheese, or bacon
Potato, rice, spaghetti, macaroni, or noodles
Finely chopped vegetable
Strained fruit or banana
Toast or graham crackers
Milk

*When vegetable is included as soup it is not necessary to give a serving of vegetable at the meal.

The same type of foods are continued as the child grows older, but the amount served is larger, and the vegetables, fruit, and meat need not be as finely divided. It is advisable to accustom the child to eat coarsely chopped vegetable and meat cut in small pieces as soon as he is able to masticate well.

Children of all ages are more or less influenced in their likes and dislikes by the habits of their associates. Parents should keep this point in mind and make sure that the child does not have an opportunity to acquire bad food habits.

REGULAR DIET FOR CHILDREN FROM 18 MONTHS TO 3 YEARS OF AGE[2]

Breakfast

Orange, grapefruit, or tomato juice
Cereal, whole-grain or enriched
Egg, 1 daily; at least 4 each week
Bread, whole-grain or enriched, toasted with butter
Milk

Dinner

Chopped meat, fish, or fowl (liver once a week)
Potato
Chopped vegetable (green or yellow)
Raw vegetable
Dessert: pudding, custard, ice cream, or plain cake
Milk

Supper

Main dish—combination of carbohydrate and protein foods
Chopped vegetable, if desired
Chopped fruit or banana
Toast or bread with butter; use wholewheat or enriched bread
Milk

REGULAR DIET FOR CHILD FROM 3 TO 12 YEARS[2]

Breakfast

Orange, grapefruit, or tomato juice
Cereal, whole-grain or enriched
Egg, 1 daily; at least 4 each week
Crisp bacon—if not served at another meal
Wholewheat or enriched bread or toast with butter
Milk

Dinner

Meat, liver, fish, or fowl—cut up for younger children
Potato, rice, spaghetti, or macaroni
Cooked vegetable—green or yellow
Raw vegetable
Dessert: pudding, ice cream, plain cake, gelatin dessert, fruit whips
Wholewheat or enriched bread with butter
Milk

Supper

Milk soup or milk toast or other combinations of protein and carbohydrate
Vegetable or salad with plain dressing or lemon juice
Dessert: fruit, banana, or other raw or cooked fruit
Wholewheat or enriched bread with butter
Milk or cocoa

Cod liver oil is continued throughout the growth period to furnish the vitamin D which is deficient in the average diet.

Amounts of Food. All children need certain foods every day in order to obtain the nutritional essentials necessary for their normal growth and development. Young children vary in the amount of the foods which they will eat at a meal. Thus it is advisable to know what amounts of food must be eaten in order that the day's diet may be adequate in every respect. The following outline

FOODS IN VARYING AMOUNTS WHICH CAN BE FED AT ONE MEAL[3]

Food	Two years	Three years	Four years
Milk	1 cup	1 cup	1 cup
Milk soup	1/3 cup	1/2 cup	2/3 cup
Egg dishes	3 tablespoons	1/4 cup	1/3 to 1/2 cup
Meat			
Patties	2 tablespoons	1/4 cup	1/4 cup
Roasts	1/2 ounce	3/4 ounce	1 ounce
Creamed	3 tablespoons	1/4 cup	1/3 cup
Vegetables			
Cooked, milk flavored	1/4 cup	1/3 cup	1/3 to 1/2 cup
Uncooked (diced)	taste	2 tablespoons	1/4 cup
(sticks)	2 sticks	4 sticks	6 sticks
Fruits			
Uncooked or cooked	1/3 cup	1/2 cup	2/3 cup
Desserts			
Whips, custards, or blanc mange	1/3 cup	1/2 cup	2/3 cup

derived from the study of the food intake of many children should be useful in the arranging of diets for children of preschool age.

Diets for Adolescent Children. When a boy or a girl reaches the age of twelve or thirteen, the period of adolescence has usually begun. The changes taking place at this time are gradual. The rate of growth increases about the twelfth or thirteenth year with girls and possibly a year later with boys. This growth is both lineal and muscular. The average increase in height for boys and girls between the ages of 6 and 17 is about two inches a year, and in the years of greatest growth about three inches, although some boys may grow as much as five inches during the period of greatest growth.

Basal metabolism is relatively high for girls of 12 or 13 years of age and for boys from 12 to 14 years; when puberty is established the basal rate drops suddenly. The nutritional requirements for both boys and girls during the adolescent period are much higher than those of adults. (See tables of recommended dietary allowances, pages 128 and 223.)

The notable increases in essential nutrients during adolescence are in protein, minerals, and vitamins. The protein must be of the best biological value in order that the growth of the muscles may keep pace with the increase in height. It is of especial importance to make the intake of calcium, phosphorus, and vitamin D completely adequate. An increase in iron is also necessary, especially for girls, during adolescence. Milk furnishes protein of the best biological value, as well as calcium and phosphorus. Diets in which the milk intake is reduced below 1 quart daily are likely to be too low in calcium and phosporus; deficiency of calcium is widely prevalent. In order to make the retention of calcium more nearly optimum, cod liver oil should be continued throughout adolescence.

The following outline furnishes a pattern on which to base the amounts of food necessary during adolescence. All of the nutritional essentials, with the exception of vitamin D, are included in adequate amounts. Cod liver oil or other fish liver oils or concentrates should be given to make good the lack of vitamin D in the food.

RECOMMENDED ALLOWANCES IN TERMS OF WEEKLY AMOUNTS

PERSONS	MILK*	POTATOES, SWEET POTATOES		TOMATOES, CITRUS FRUIT		LEAFY, GREEN, YELLOW VEGETABLES		DRIED BEANS, PEAS, OR NUTS		DRIED FRUIT	
	Quarts	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
Boys:											
11 to 12 years	7	2	3	1	12	3	12	0	2	0	4
13 to 15 years	7	3	0	2	0	3	0	0	4	0	5
16 to 19 years	7	4	4	2	0	3	0	0	4	0	6
Girls:											
11 to 13 years	7	2	0	1	8	2	8	0	1	0	4
14 to 19 years	7	2	0	1	8	3	8	0	2	0	4

* Or equivalent in cheese, evaporated milk or dried milk; 5 ounces of American cheese (cheddar) or 1 quart of skimmed milk and $1\frac{1}{2}$ ounces of butter; or $4\frac{1}{2}$ ounces of dried milk (whole) or $3\frac{1}{2}$ ounces of dried skim milk and $1\frac{1}{2}$ ounces of butter; or 17 ounces of evaporated milk are equivalent to 1 quart of whole fluid milk.

** Count fatty bacon, fat back as fat not as meat.

Food Habits. The psychological aspects of infant and child feeding have long been a subject for much discussion. There are many problems in addition to those pertaining to food preparation and planning. Why does one child refuse to eat a food which another will eat with relish? How can one induce such a child to eat that which is necessary for his health without making him feel his own importance? Children who have poor appetites or an intolerance to certain foods require special attention. Experience has proven many of the problems of child feeding to be of a psychological nature. Some of the difficulties may be traced to neglect in the training of the child during the early months and years of life. The non-establishment of good food habits during the first year of life may account for the rebellion against food manifested by many children.

Probably anorexia is the commonest complaint from mothers in relation to children's food habits. It is necessary to find the cause for a refusal of food on the part of the child and then to endeavor to remove the causative factor. With infants excessive dilution of the formula has been found to be a cause for refusing the bottle,

FOOD FOR ADOLESCENT BOYS AND GIRLS †

WEEKLY AMOUNTS

Other vegetables, fruits		Eggs	Lean meat, poultry, fish **		Flour bread ***		Sugars ****		Butter		Other fats	
Lbs.	*Oz.*	*Number*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
4	0	6	2	8	2	8	0	12	0	8	0	4
5	8	6	2	12	3	4	1	0	0	8	0	8
6	0	5	3	0	3	12	1	8	0	8	1	1
3	4	7	2	0	2	8	0	12	0	8	0	4
4	0	6	2	8	2	8	0	12	0	8	0	4

*** Count $1\frac{1}{2}$ pounds of bread as 1 pound of flour.

**** Includes white sugar, maple sugar, syrups, molasses, jellies, preserves, candies, etc.

† Consumer's Guide, Vol. 1. VII. No. 4, Nov. 15, 1940.

while with young children the cause may be traced to a monotony in the texture of the food or to lack of variety. Too long continued use of sieved vegetables and fruits may cause an active dislike for that food; it may also cause the child to become lazy and to refuse to chew the coarser foods when they are indicated. It is wise to gradually change from strained to chopped foods. After six months of age most children can handle fruits and vegetables of a little coarser texture and the transition from the very smooth to the more coarsely strained and chopped fruits and vegetables is desirable.

Refusal to take milk is a serious matter since it is the only good food source of calcium. The objection to drinking milk may be to its flavor, its odor, or its color, all of which may be changed with a little effort. A drinking straw frequently overcomes the odor problem, a small amount of cocoa takes care of the color, and of the flavor. If the refusal of milk is traced to a real allergy it is a problem for the physician to solve. Fortunately, true allergies are not as common as many people believe.

Good food habits are more easily established during the first year of life than later on. Children can be taught to eat the foods that

are best for them by beginning with very small portions and gradually increasing to the amounts which are needed to furnish the essential nutrients.

SUMMARY

Childhood represents the most important growth period of life, and therefore calls for great care and attention to make sure that all of the essential nutrients are included in the diet.

Protein, calcium, and vitamin D are frequently found to be deficient in the diets of children, especially in those diets in which the intake of milk is low or lacking. Milk furnishes protein of unexcelled quality and is also the most consistently good food source of calcium; it is practically impossible to make the diet of children completely adequate without it. The need for vitamin D does not stop with the stage of infancy, since growth continues from birth to maturity. During the adolescent period it is of especial importance. Since there are few, if any, good food sources of vitamin D, cod liver oil begun during the first few days of infancy should be continued until adolescence is completed. According to Jeans[4]: "When the calcium and phosphorus intakes are adequate and appropriate, from 300 to 400 I.U. of vitamin D daily will produce retentions of these minerals ample to satisfy the theoretical requirements of normal growth."

Rarely does the lack of one nutritional essential occur alone. For example, when symptoms of vitamin A deficiency develop, investigation will almost always show a deficiency in other essentials also. Thiamine is not always present in sufficient amounts in the diet of children. Deficiency is always likely to occur when the diet is low in whole-grain cereals or bread, and in fruits and vegetables. A more careful selection of the unrefined food products rather than resorting to the use of vitamin concentrates is advisable.

Good food habits should be established during the first year of life. It is much easier for a child to learn to eat and like foods that are good for him at this time than later when his tastes have been influenced by those of his parents or associates.

PROJECTS

1. Plan an adequate diet for a child of two years. Calculate the protein, calcium, and thiamine.
2. Plan a day's menu for a child 10 years old which includes all of the "must" foods.
3. Outline an adequate diet for a boy 15 years old. Show what changes might be made in this diet for a girl of the same age.

REVIEW QUESTIONS

1. In what period of life is growth most rapid? What is the normal rate of gain for a child of 5 years?
2. What factors determine the energy requirements of healthy children?
3. What nutrients are most frequently deficient in the diets of children?
4. State the effect of a deficiency of calcium and vitamin D in the diet of a child.
5. Name the foods which must be included in the diet of children every day. Give reasons.
6. A child of two refuses to drink his milk and to eat chopped vegetables. What may be some of the reasons for this refusal? What measures would you take in order to obtain adequate intake of these foods?

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CHAPTER XVIII

Feeding the Aged

The feeding of individuals who have passed the milestone of middle age is a problem which has been more or less overlooked in our studies of nutritional adequacy for different age groups, and now that so many people are living beyond the sixth decade it would seem to be an important point on which to center our attention.

Undoubtedly man's span of life has been considerably extended, but it is a question as to whether the onset of senility has been correspondingly delayed.[1] Old age should be an asset rather than a liability, for the experience gained through the living of 60 years or more should rightly bring good judgment and efficiency to the individual. To prolong the period of youth and middle age is a worth-while undertaking and to "add life to years rather than years to life"[2] should take away some of the fear of old age and give to the individual more interest in life. The problem then is: How is it possible to delay the process of aging and build up the efficiency and good judgment of that ever increasing group of people over 60 years of age so that they may be a beneficial influence in a world standing in great need today?

It is understandable that age brings with it certain handicaps such as "a decrease in resistance, a progressive alteration of vital physiological function, as well as changes in the blood vessels, metabolism and a lowered resistance to shock."[3] However, it is possible in many cases to improve the health and increase the vitality of those who have passed middle age if they show a willingness to accept the information offered and put into practice the rules governing their mode of life, with special regard to their food habits.

That nutrition plays an important part in the building up of resistance and increasing efficiency of individuals of all ages has been proven, but unless a state of good nutrition has been estab-

lished and maintained throughout the period of youth and middle age the individual of 60 years or more cannot hope to enjoy the same degree of health that might otherwise have been expected.

Points to Be Considered. There are a number of factors to be considered in this all important subject of feeding the aged: (1) the constituents of an adequate diet for the individual of 60 years and over; (2) the nutritional status of the individual; (3) the pathological conditions which may be present in the individual; (4) the psychological aspects of the case, food habits, willingness to accept instructions as to diet, and the ability to put into practice the rules pertaining to good nutrition; (5) the religious and racial customs which may or may not interfere with the carrying out of these rules. All of these factors are important, and others, such as the fallacy that all people who have reached the age of 60 must drastically reduce their diet, must be given careful attention and corrected when necessary. Of course, a person who has no teeth, whose digestion is poor, and who is prone to suffer from various aches and pains must necessarily adjust his diet to suit his individual condition. In general, the dietary needs of the healthy normal man or woman of 60 years or more are governed by the same physiological rules that pertain for younger adults.

Metabolism in the aged is usually reduced about 10 to 15 per cent, but this reduction should not entail a great sacrifice on the part of the individual. If one eats beyond his daily needs, that is, if the caloric intake greatly exceeds one's energy requirements, the individual is likely to put on too much weight. Since obesity carries with it the burden of lowered resistance to infections, especially pneumonia, and a progressive susceptibility to those diseases so common to middle age — diabetes, coronary disturbances, impairment of the liver, and gout — a diet high in calories is not advisable. On the other hand, under-nutrition is definitely undesirable as poorly nourished organs cannot function properly. For example, the work of the liver which does not receive ample protein is hampered; nutritional anemia and nutritional edema may develop. In other words, a scientifically planned diet will delay the onset of the ravages of age.

Any diet which contains all of the essential nutrients is an adequate diet, but it must be remembered that even if the diet is

adequate the individual can be well nourished only if the food eaten is properly digested, absorbed, and utilized by the body. The process of aging depresses not only the metabolism but also the digestion and utilization of the food eaten, and these facts must be considered when adjusting the individual diet.

Dietary Allowances. There is a difference between the optimal diet and the barely adequate diet. The optimal diet has not been exactly determined for any age, and probably less information is available on this subject for the aged than for any other group. But, if an adequate diet is reinforced with such essential nutrients as may be individually indicated, the nutritional status of the person concerned will be improved.

Protein. Every living body requires protein daily for the maintenance and replacement of the tissues. The blood making organs must be supplied with a sufficient amount of good quality protein. Research has shown that the health of the liver is dependent upon this nutrient. Tuohy calls attention to "how the essentialness of the amino acids keep step with the components of B complex and B_1"[1] and Whipple states that animal protein buffers the liver for blood plasma restoration. All authorities agree that 1 Gm. of protein per kilogram of ideal body weight is essential for adults of all ages. Since there is some evidence that a large amount of protein is not as easily digested and metabolized by the elderly as by younger individuals, it is usually advisable to avoid intakes in excess of this standard.[4]

Calories. The caloric requirement for aged people is based on ideal weight for age and on muscular activity. Rose[5] suggested a scheme for calculating the energy needs of individuals of 60 years and over as follows: "Calculate their energy needs on a basis of weight and muscular activity, then deduct 10 to 15 per cent of the total calories to compensate for the reduction in metabolism." For example, an average, normal, moderately active man of 40 years weighing 70 kilograms would require approximately 3000 calories a day. This same man having reached 60 years of age, still moderately active, would probably require 2600 to 2700 calories, allowing for the reduction in metabolism. The maintenance of ideal weight is the final criterion as to one's optimum caloric intake.

Distribution of Calories. The relation of fat to carbohydrate in

the diet of aged persons has been especially emphasized. There is evidence to show that too much fat in the diet exerts a detrimental effect upon the liver, the heart, the kidneys, and especially the blood vessels. Therefore, in adjusting the calories for members of the old age group, it is advisable to limit calories derived from fat to a certain extent and substitute easily digested carbohydrates to make up the essential heat units.

Minerals. There is little if any available evidence to show that the individual of 60 years or more requires less calcium, phosphorus, and iron than an individual of lesser age. The functions of these minerals have been thoroughly discussed in Chapter VI. Certainly the regulation of body processes, which is an important work of these constituents, is as important to the elderly individual as to the younger adult. In fact, experimentally it has been found that a diet which is above the "average standard" in calcium leads to an above average measure of health, bringing about an improvement in the utilization of food, an increase in vitality, and a lengthened period between the attainment of maturity and the onset of senility.[2] Milk, which is the best source of calcium, is therefore recommended in the diet of the old as it is in the diet of the young.

When the daily intake of food contains sufficient protein to cover the needs of the individual, it is believed to furnish an adequate amount of phosphorus as well. As age advances there is a tendency to develop a mild type of anemia; therefore, foods rich in iron should have a place in the diet. Liver once or twice a week is effective in combatting such a tendency in the aged person. The Food and Nutrition Committee of the National Research Council recommends 0.8 Gm. of calcium, and 12 mg. of iron daily.[6]

Vitamins. Vitamins are known to be necessary for the maintenance of normal metabolic processes, good digestion, absorption, utilization, and elimination, as well as for good appetite and normal vision. Therefore it is reasonable to suppose that elderly individuals need the offices of these factors as well as those who have lived a far shorter time. The recommendations of the National Research Council for moderately active women and men are: 5000 I.U. vitamin A; 1.2 to 1.5 mg. thiamine; 1.6 to 2.0 mg. riboflavin; 12 to 15 mg. niacin; 70 to 75 mg. ascorbic acid. (See page 129 for vitamin requirements of less active individuals.)

Water and Cellulose. Water is especially essential for members of the old age group, for it is not only a mild stimulant, but it also helps to combat constipation. The same is true of cellulose, and while rough bran is not advisable for the aged, the fiber of tender vegetables, fruits, and whole grain cereals will make the passage of the food mass down the intestinal tract easier.

Planning the Daily Diet. The following suggestions are quoted from a pamphlet prepared by Miss Gillett.[7]

These foods should be used daily.

From a pint to a quart of milk
One or more servings of fruit, with citrus fruit or tomatoes daily if possible
Servings of two or more vegetables, including potatoes
An egg at least every other day
One serving of meat or fish; or if preferred an egg and at least three glasses of milk
Enough bread, cereals, and fats to maintain a desirable weight
Only moderate amounts of sweets, tea, and coffee

These food habits aid digestion and health.

Something hot at each meal is desirable.
Clear soup at the beginning of a hearty meal aids digestion.
Four or five light meals instead of three hearty ones often favor more complete digestion and freedom from distress.
When the heartiest meal is at noon and the evening meal is light, sleep is less likely to be disturbed.
A glass of hot milk just before going to bed may induce sleep.

These foods are easy to eat when chewing is difficult.

Milk to drink, plain and in egg nog
Soft raw fruit, cooked fruit, and fruit juices
Cooked cereals, including rice and spaghetti
Soups, clear or milk, and stews
Eggs, soft cooked, poached, scrambled; fish; chopped meat
Cottage and cream cheese; cheese sauce on moistened toast, boiled rice, potatoes or other vegetable
Vegetables cooked until tender and mashed, puréed, or chopped
Desserts: custard; fruit whip; cooked fruit; ice cream; ice; and gelatin and cereal puddings.

These foods may cause distress; avoid them if they do.

Fats retard digestion and may cause distress. It is well to avoid;
Either cabbage or beans when cooked with salt pork or other fat

Rich dressings, gravies, and sauces
Fried eggs and other fried foods
Rich puddings, cakes, pastries, and doughnuts

Sweets help to give quick relief from fatigue, but too much sugar may cause fermentation, discomfort, and perhaps illness. Sweets should not be taken in such amounts and at such times as to decrease the appetite for milk, vegetables, and fruit.

If tea and coffee cause sleeplessness or overstimulation, greater comfort will result if they are omitted.

Malnutrition in the Aged. There are a number of causes for the slowing down of vitality and efficiency so commonly seen in individuals past middle age. Some of these have already been discussed, but there are others which are worthy of mention here. The loss of natural teeth and a seeming inability on the part of the individual to become accustomed to artificial dentures, or poorly fitting dentures that slip and make a noise when the individual talks or endeavors to eat, make it difficult to masticate the food properly or eat with comfort. Either of these will interfere with a proper utilization of the food eaten. Another problem along these same lines is the malformation of the jaw and faulty tooth alignment believed to be traceable to inadequate prenatal nutrition. Such malformations are not overcome with age and therefore should be considered as factors favoring malnutrition.

The poor appetite and impaired digestion noticed in many individuals of 60 years or more may result from a decline in the normal acid content of the gastric juice which occurs in a number of individuals of 40 years of age, and the appearance of achlorhydria in 35 per cent of those who have reached 65 years and over.[1] Any marked change in the normal functions of the body must necessarily reflect upon the health and efficiency of the individual in which they occur.

SUMMARY

A more efficient and more abundant life is a goal toward which people of all ages should strive. Elderly individuals are urged to make their years of experience an asset instead of a liability.

As old age approaches nature places a brake upon the wheels of life, but the slowing down of the metabolic processes under normal conditions does not impose drastic restrictions upon the food intake

of all elderly individuals. As a rule from 10 to 15 per cent reduction in calories is advisable after the sixtieth milestone has been passed.

In adjusting the calories in the diet, certain restrictions in the fat content are necessary in order to safeguard the liver, the heart, the blood vessels, and the kidneys from damage which is likely to occur when this nutrient is allowed even in the amounts ordinarily permitted.

For the health and well being of the liver as well as for the rest of the body an adequate intake of good quality protein is essential in the diet of elderly individuals. Nutritional anemia and nutritional edema is likely to occur when this all-important nutrient is deficient in the daily dietary.

Overnutrition (obesity) is to be avoided since it tends to lower the resistance to those disturbances which so frequently develop from middle age on.

Vegetables and fruits, whole-grain cereals and breads should form an important part of the diet, and foods rich in fats should be discouraged. Cottage cheese is a valuable food in that it contains good quality protein as well as a fairly liberal amount of calcium.

Tea and coffee are not objectionable for this age group when taken in reasonable amounts and they afford a mild stimulation which may be desirable. Excesses in alcoholic beverages, however, are more or less dangerous.

Lessened appetite, loss of teeth, and impaired digestion may interfere with complete utilization of the diet in some cases. Thus it may be necessary for the elderly person to obtain his essential vitamins from concentrates, but this is a problem for the physician, not the nurse.

Regularity in the taking of food, water, and exercise is desirable. Water and food both seem to exert a stimulating effect upon the elderly individual; a warm drink before retiring frequently induces sleep.

Good food habits should be learned early in life since the changing of a life long custom is more or less difficult for the one who has passed middle age. As a rule even a bad habit is given up with reluctance. To convince members of this ever growing old age group of the worthwhileness of being adequately nourished is a goal toward which every physician, dietitian, and nurse should work.

PROJECTS

1. Calculate an adequate diet for a moderately active man 70 years of age weighing 70 kilograms.

2. Calculate an adequate diet for a woman 65 years of age living an inactive life and who weighs 80 kilograms when she should weigh 60 kilograms.

REVIEW QUESTIONS

1. Name some of the factors which make the feeding of the aged different from the feeding of younger individuals.

2. What is the difference between the caloric needs of individuals of 60 years and over and the requirements of younger adults? Why?

3. What are the protein needs for members of the old age group?

4. Why is an adequate protein intake so essential to elderly individuals?

5. Name one organ which is especially affected when the protein in the diet is insufficient.

6. What nutrient is more or less restricted in the diet of the aged? Why?

7. Which minerals are especially important in the diet of individuals over 60 years?

8. List some of the psychological factors which influence the diet of elderly individuals.

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SECTION III

Diet Therapy

CHAPTER XIX

Feeding the Sick

In previous chapters of this text a study has been made of food and its uses in the normal body. The theory of good nutrition and its relation to health has been established. Having learned the factors which influence the use of food in health, the student must now learn the limitations which disease places upon the daily dietary.

Diet therapy, then, is the science of modifying the normal diet to meet pathological conditions. Its purposes are (1) to correct nutritional deficiencies which may have occurred; (2) to afford rest to the whole body or to certain organs which may be affected; (3) to adjust the food intake to the body's ability to metabolize the nutrients; and (4) to bring about change in body weight whenever necessary. Diet therapy in most instances is not a remedy in itself but is a measure which supplements and makes more effective the medical or surgical treatment.

Objectives for the Student. The student nurse who begins her study of diet therapy should keep several objectives constantly in mind. Ever in the foreground should be the important knowledge of the essentials of an adequate diet for the normal individual. With this information it is then possible to understand the principles of dietary modification. Such alteration of the normal diet requires an appreciation of (1) the underlying disease conditions which require a change in the diet, (2) the possible duration of the disease, and (3) the factors in the dietary which must be altered to overcome these conditions. When the nurse comes in contact with the sick patient she has an opportunity to translate her theoretical knowledge of normal nutrition and diet therapy to practical usage. This implies, however, the ability to adapt the principles of the various therapeutic regimens to daily planning of correct, palatable, and adequate diets. It necessitates, further, an ability to prepare, measure or weigh, and attractively serve the stipulated foods. It

entails an evaluation of the effectiveness of the diet as determined by visits with the patient, and notations of the patient's progress. Finally, it requires the necessary insight to the psychological problems of eating, and the subsequent education of the patient.

It is the obligation of the nurse, then, to intelligently and conscientiously carry out to the best of her ability the diet prescriptions which the physician has ordered.

Artificial Methods of Feeding. Under normal conditions food enters the body through the mouth, but there are certain circumstances which make it necessary to introduce food in other ways. Deformities or inflammation of the mouth or throat, corrosive poisoning, unconsciousness, paralysis of the throat muscles, etc., are only some of the reasons why artificial methods of feeding must be used. Under such circumstances tube feeding is accomplished by providing nourishment in liquid form through a rubber tube inserted through the mouth, the nasal passages, or an opening in the gastrointestinal tract. Quite often it is necessary to rest the patient's stomach completely, and nourishment is given subcutaneously or intravenously. Fluids given by such means may include glucose, amino acids, salts, and the water-soluble vitamins. Transfusions of whole blood or of plasma are commonly used since they are of great restorative value. Feeding by the rectal drip method is occasionally resorted to but absorption is very incomplete. Solutions of glucose are most satisfactory for this purpose. These artificial methods of feeding are medical procedures.

Routine Hospital Diets. In the hospital the majority of patients are given the so-called routine diets according to their personal needs. It is with these routine diets that the nurse comes in contact during the early period of her training. Thus she is thoroughly familiar with the liquid, soft, and full or regular diets before she receives her training in the planning and serving of special diets. In these routine diets the nurse recognizes immediately that the modification to be made is chiefly in consistency and that the diets are progressive steps in the dietary treatment of the patient.

Liquid Diets. Fluid diets are used whenever the patient is unable to tolerate solid foods because of the nature of the illness or because of surgical procedures. The degree to which these diets are adequate will depend upon the type of liquids permitted.

Clear Fluid Diets. Whenever an acute illness or surgery produces a marked intolerance for food as may be evident by nausea, vomiting, anorexia, distention, and diarrhea, it is advisable to restrict the intake of nutrients. In such instances tea, coffee, broth, and carbonated beverages, as gingerale, may be the only foods permitted. The amount of fluid is usually restricted to 30 or 60 cc. per hour at first, with gradually increasing amounts being given as the patient's tolerance improves. Obviously such a diet can accomplish little beyond the replacement of fluids. It is usually used for one to two days at the end of which time the patient is commonly able to retain and utilize a more liberal liquid diet. Fruit juices are generally omitted on clear fluid diets since they are believed to stimulate gas formation. Conclusive evidence on this last point, however, is lacking.

Recent studies in diet therapy indicate the importance of avoiding the depletion of body reserves of protein especially, and a more liberal clear-fluid diet permits the use of strained fruit juices with egg white, whole egg, gelatin, and cereal waters. Whenever a fluid diet without milk must be used for more than one or two days, the following plan has been found to be of value.

CLEAR FLUID DIET WITH ADDED PROTEIN
TYPE DIET

Breakfast

Strained fruit juice with one egg white
Thin cereal gruel with glucose
Tea with gelatin and glucose

Midmorning

Lemonade with egg white

Luncheon

Broth with whole egg and gelatin
Tomato juice with egg white

Midafternoon

Grape juice with gingerale and egg white

Supper

Broth with gelatin
Pineapple juice with egg white
Fruit juice jelly

Bedtime

Orange juice with one whole egg

The amount of each feeding will have to be adjusted to the patient's tolerance; in some instances very small amounts of fluid — 60 to 90 cc. — every hour may be indicated. Many variations in the arrangement of fluids are possible. The recipes for beverages (page 582) will prove to be of great value in the planning and preparation of this diet.

Full Fluid Diet. As the name implies, this diet permits the use of all foods in fluid form — those already allowed on the clear fluid diet plus all milk beverages and cream soups. It also allows the use of ice cream, ices, custards, and junket. When properly planned this diet can be used for relatively long periods of time since it is possible to include all of the food essentials. It is used as a logical step of progression from a clear fluid diet. It is also indicated whenever a patient has an acute infection where a soft diet is not tolerated. The patient's limited capacity for food requires that it be given in about six feedings, although larger volumes of fluid can be administered at one time than is the case with clear-fluid diets. The caloric value of this diet can be markedly increased by the use of 10 per cent cream which is merely a dilution of coffee cream with equal parts of milk. This concentration of fat seldom produces anorexia. Because of its limited sweetening power glucose is also a valuable aid in raising the caloric intake. The protein intake can be increased by the liberal use of milk, eggs, egg white, gelatin, and dried milk in beverages and soups.

FULL FLUID DIET

TYPE DIET

Breakfast

Strained fruit juice
Cereal gruel with milk and sugar
Hot beverage with cream and sugar

Midmorning

Strained citrus fruit juice

Luncheon

Cream soup
Tomato juice
Chocolate milk
Fruit juice gelatin, custard, junket, or ice cream

Midafternoon

Malted milk

Supper

Strained clear soup
Strained fruit juice
Milk, plain or flavored
Ice cream, custard, junket, or fruit juice gelatin

Bedtime

Eggnog, plain or flavored

Soft Diet. The soft diet represents the usual dietary step between acute illness and convalescence. As a rule, a soft diet is made up of simple, easily digested food and contains no harsh fiber, no rich or highly seasoned food. It should be well prepared and is entirely adequate from a nutritional standpoint. It may be ordered as a soft diet without meat whenever it is felt the patient is not yet able to tolerate meat.

SOFT DIET[1]

Include these foods daily:

2 cups (1 pint) milk
1 serving (3 ounces) ground meat, fish, or fowl
2 eggs or 1 egg and a substitute of soft cheese, milk, ground meat, or fish
3 teaspoons butter or fortified margarine
2 servings strained whole-grain cereal or fine whole-grain bread
2 servings strained fruit
½ cup orange, grapefruit, or tomato juice
1–2 servings strained vegetable in addition to
1 or more servings potato, strained corn, or strained dried beans
Other foods as allowed to provide adequate calories
6–8 glasses water

Foods allowed:

All beverages and strained soups

Breads, crackers, and cereals — white, fine wholewheat, and rye bread without seeds; white crackers; dry cereals such as cornflakes, Rice Krispies, puffed rice, and Pablum; fine cooked cereals such as farina, Cream of Wheat, Ralston, cornmeal, hominy grits, rice, noodles, spaghetti, and macaroni; strained coarse cereals such as oatmeal, Pettijohns, and wholewheat cereal

Desserts — custard, cornstarch, tapioca, rice, and bread puddings; cake, cookies, frozen and gelatin desserts — all without nuts and whole fruit

Fruits — strained cooked fruit, fruit juice, and ripe banana
Vegetables — strained cooked vegetables except strongly flavored ones; strained sweet potato; white potato any way except fried
Meats — any ground meat, fish, shell fish, and fowl without bones or gristle
Eggs — any way except fried
Cheeses — mild, soft cheese such as cream, cottage, and grated American cheese in sauce

Foods to avoid:

Breads, crackers, and cereals — coarse dark bread; whole-grain crackers; coarse dark cereals unless strained
Desserts — rich pastries and any dessert containing nuts, raisins, or whole fruit
Fruits — raw fruit except juice and ripe banana
Vegetables — raw and coarse; strongly flavored vegetables such as broccoli, Brussels sprouts, cauliflower, cucumber, onion, radish, turnip.
Meats — tough meat with gristle, bone or fat; salted and smoked meat and fish; pork
Excessive seasonings and fried foods

Intervals of Feeding: Three meals daily are usually given. Intermediate feedings of high caloric beverages may be used to combat loss of weight and strength.

TYPE DIET	SAMPLE MENU
Breakfast	
Strained fruit or fruit juice	Banana
Cereal — strained, if coarse	Strained oatmeal
Milk and sugar for cereal	Milk and sugar for cereal
Egg	Soft cooked egg
Soft roll or toast with butter	Toast, buttered
Hot beverage with cream and sugar	Coffee
Luncheon or supper	
Strained soup, if desired	Cream of tomato soup
Egg or substitute of mild cheese, ground meat, or fish	Cheese soufflé
Potato without skin, rice, noodles, spaghetti, macaroni, or strained vegetable	Strained peas
Bread with butter	Bread with butter
Strained fruit	Applesauce
Milk	Milk

TYPE DIET	SAMPLE MENU
Dinner	
Tomato, orange, or grapefruit juice	Grapefruit juice
Ground meat, fish, or fowl	Beef patty
Potato, any way except fried	Mashed potato
Strained vegetable	Strained carrots
Bread with butter	Bread with butter
Dessert	Tapioca pudding
Milk	Milk

Regular or Full Diet. The name of this diet speaks for itself. It is the diet served to all patients until specific dietary orders are given by the physician. A person who is confined to bed is not able, as a rule, to handle a menu as unrestricted as that allowed an individual who is up and about. In the first place he has little appetite because his physical activity is curtailed; and in the second place, he needs less than a normal energy intake because of this very confinement. The regular hospital diet is comparatively liberal but is made up of more or less simply prepared foods which are easy to digest. Dishes which are likely to disagree such as rich pastries are not given to bed patients.

REGULAR OR NORMAL DIET[1]

Include these foods daily:

2 cups (1 pint) milk
1 serving (3 ounces) meat, fish, or fowl
2 eggs or 1 egg and a substitute of cheese, milk, meat, or fish
3 teaspoons butter or fortified margarine
2 servings whole-grain cereal or whole-grain bread
2 servings fruit — preferably one to be orange, grapefruit, or tomato
2 servings vegetable, in addition to one or more servings of potato, corn, or dried beans
Include other foods to provide adequate calories
6 to 8 glasses water

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Banana
Cereal, preferably whole-grain	Oatmeal
Milk and sugar for cereal	
Egg	Soft cooked egg
Roll or toast with butter	Wholewheat toast
Hot beverage with cream and sugar	Coffee

TYPE DIET	SAMPLE MENU
Luncheon or supper	
Soup, if desired	
Egg or a substitute of cheese, meat or fish	Cheese soufflé
Potato, rice, noodles, macaroni, spaghetti or vegetable	Buttered peas
Salad	Lettuce and tomato salad Russian dressing
Wholewheat bread with butter	Graham roll with butter
Fruit	Royal Anne cherries
Milk	Milk
Dinner	
Meat, fish, or fowl	Meat loaf with gravy
Potato	Mashed potato
Vegetable	Buttered carrots
Wholewheat bread with butter	Wholewheat bread with butter
Dessert	Apple cobbler
Milk	Milk

Dietary Modifications. The routine hospital diets are modifications in consistency, whereas certain disease conditions may require alterations in the amounts of one or more of the food constituents, or changes in bulk. Normal nutrition must always be the first consideration, and it is imperative that the normal diet should be modified only as far as necessary for the disease in question. Throughout this text diets in use at various hospitals have been adapted in so far as possible to a standard style of presentation. The *type diet* is nothing more or less than a pattern or a guide in any given instance. With its use one can quickly determine the adequacy of the diet planned for any specific patient. It is of the utmost importance, however, that a type diet is not accepted as a final system which cannot be changed. The intelligent cooperation of the doctor, the nurse, and the dietitian is required so that the patient's dietary needs can be satisfied even though problems of race, religion, economy, occupation, and idiosyncrasies enter in. Let the type diet, then, be a guide — not an inflexible rule!

The tables on pages 252-267 indicate the principal deviations from the normal diet which are most commonly used. More detailed descriptions will be found in the chapters which follow.

PROJECTS

1. Plan a full fluid diet for one day which will contain 2500 calories. Calculate the protein, calories, iron, and vitamin C. Compare with the normal requirements for an adult.

2. List six ways in which protein intake can be increased on a full fluid diet.

3. Write a menu for one day for a clear fluid diet with added protein. Allow at least 50 grams of protein in this diet. Calculate the caloric value.

4. Write a menu for one day for a patient who is to receive a regular diet. Indicate the changes you would make in order to make this menu suitable for a patient receiving a soft diet.

REVIEW QUESTIONS

1. What is meant by diet therapy?

2. The normal diet is used as a basis for planning all special diets. Why?

3. List four primary purposes of diet therapy. Give an illustration of each.

4. What are seven objectives which the student nurse should keep in mind if she expects to make the best use of her work in diet therapy?

5. What is meant by routine house diets?

6. What foods must be included daily to insure an adequate diet? What amounts of each would be desirable for an adult?

7. What foods are usually allowed on a clear fluid diet? What nutrients are lacking in this diet?

8. What is meant by albuminized fruit juice?

9. Compare the regular and the soft diet.

10. What changes if any would you make for a patient receiving a regular diet, as compared to the diet for a normal adult?

11. What is meant by a type diet? What are its advantages? What are its limitations?

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1. Nutrition Department of Presbyterian Hospital: *Manual of Diets*, New York, 1943.

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications of the Normal Diet Used	Foods to Be Included; Foods to Be Avoided; Intervals of Feeding
Regular or Normal Diet.	Most frequently used of all hospital diets; used for all ambulatory and bed patients whose condition does not necessitate a special diet or one of the following routine diets. Most special diets progress ultimately to the regular diet.	The full hospital diet is simple in character and preparation, easy of digestion, and sufficient to afford nutritional requirements with minimum effort to the body. The diet is well balanced, adequate in nutritional value, and attractively served to stimulate a possibly poor appetite.	*Foods Included:* All foods which are easy to digest such as milk in any form, eggs, cooked and raw vegetables, cooked and raw fruit, cereal and bread, meat, poultry, fish, [illegible]. *Foods to Avoid:* Highly seasoned foods, rich pastries and puddings, fried foods. *Intervals of Feeding:* Three meals daily, unless the physician orders between meal nourishments.
Clear Fluid Diet.	In acute infections before diagnosis; in acute inflammatory conditions of the intestinal tract; in acute diarrhea; following operations upon the colon or rectum when it is desirable to prevent evacuation from the bowel for several days. To relieve thirst, to supply the tissues with water, to aid in the elimination of gas, to prevent [illegible].	The diet is made up of clear liquids that leave no residue; it is non-gas-forming, non-irritating, and non-stimulating to peristaltic action. This diet is entirely inadequate from a nutritional standpoint since it is deficient in protein, minerals, vitamins, and calories; it should not be continued for more than 24 to 48 hours.	*Foods Included:* Tea, coffee, and coffee substitutes; fat-free broths; plain or carbonated beverages as coca-cola and ginger-ale; sugar in moderation as glucose or sucrose. *Foods to Avoid:* Milk, cream, butter, fruit juice, and all solid foods. *Intervals of Feeding:* Small amounts of liquids are given at intervals of one to two hours.

Clear Fluid Diet with Added Protein.	Acute infections; diarrhea; following operations.	Differs slightly from the clear fluid diet in that it allows fruit juices and egg as reinforcing agents. This diet is also inadequate but less so than the clear fluid diet; it may be used a few days longer without danger, but it should not be used so long that the body is forced to use much of its own tissues.	*Foods Included:* Tea, coffee, coffee substitutes; fat free broths; strained fruit juices; albuminized fruit juices; plain gelatin made with strained fruit juices; thin water gruels. *Foods to Avoid:* Milk, cream, lactose, milk products, and all solid foods. *Intervals of Feeding:* Usually every hour or two.
Full Fluid Diet.	This diet bridges the gap between the clear fluid and soft diet. It is used following operations; in acute gastritis, acute infections, and diarrhea, when milk is permitted; for patients not requiring a special diet but too ill to eat solid or semi-solid foods.	The normal diet is restricted to those foods which are liquid or which readily become liquid on reaching the stomach. This diet may be made entirely adequate and may be used over an extended time without fear of deficiencies developing, provided it is carefully planned.	*Foods Included:* All liquids included in the clear fluid diets plus: milk in all forms, including malted milk beverages, milk shakes, chocolate milk or cocoa, eggnogs; soups; soft custard; plain ice cream; junket; tomato juice and fruit juices; gelatin dishes. *Intervals of Feeding:* Usually two- to four-hour intervals.
Soft Diet.	This is one of the most frequently used routine diets; many hospital patients are placed on this until a diagnosis is made. It bridges the gap between acute illness and convalescence.	The diet is liberal and entirely adequate; it is soft in consistency and contains no long fibers. It is often modified further for certain pathological conditions.	*Foods Included:* All foods on liquid diets plus: strained or fine cereals; white or fine whole-grain bread; puréed mild flavored vegetables; strained fruits and ripe banana; plain puddings, cakes, and cookies; ground or minced meat, fish, or poultry; eggs in any form except fried; mild cheese.

ROUTINE HOSPITAL DIETS (*Continued*)

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications in the Normal Diet Needed for Specific Disturbances	Foods to Be Included Foods to Be Avoided Intervals of Feeding
Soft Diet. *(Continued)*			*Foods to Avoid:* Soft hot breads; coarse cereals or bread; raw fruit; raw and strongly flavored vegetables; rich pastries; highly seasoned food; tough meat. *Intervals of Feeding:* Usually three meals, intermediate feedings may be ordered.
High Cellulose Diet.	When there is a marked stasis in the colon resulting from impairment in the tone of the muscles lining the tract — atonic constipation.	Normal diet with cellulose increased to 10 or 11 Gm. daily. Fluid intake is increased to 8-10 glasses of water (or equivalent) daily; two glasses of water are taken before breakfast. Concentrated foods are restricted because of their limited bulk.	*Foods Included:* All long fibered vegetables as greens, kale, cabbage, lettuce, celery, spinach, etc. Special stress on raw vegetable salads. All fruits, with skins when tender. Whole-grain cereals and breads with bran in fine division. Milk, meat, fish, fowl, eggs, butter as desired for normal nutrition. *Foods to Avoid:* Highly refined and concentrated foods; fried foods; excessive amounts of coarse bran; excessive seasonings. *Intervals of Feeding:* Three meals daily.

High Cellulose Diet. *(Continued)*			Water and fruit juices between meals, before breakfast, and before retiring.
Soft Moderately High Cellulose Diet.	When there is abnormal irritation of the intestines, bulk must be provided in smooth, finely divided form. 1. Spastic constipation. 2. Mucous colitis.	An adequate diet containing soft, bland foods to avoid chemical or mechanical irritation is used. Brewer's yeast is often indicated as a supplementary source of B complex vitamins. Bulk is provided by using foods containing cellulose in finely divided form; that is, puréed fruits and vegetables. Eight to 10 glasses of water or fluid equivalent are required daily. Good habits of personal hygiene, relaxation, and freedom from nervous upsets are of fundamental importance.	*Foods Included:* All foods on a soft diet, allowing at least 2 servings strained and cooked fruit, 1 serving citrus juice, and 2 servings strained and cooked vegetables. *Foods to Avoid:* Coarse breads, crackers, and cereals; rich desserts containings nuts and fruit; fried foods; condiments; raw or unstrained fruits and vegetables; tough meats; relishes and pickles. *Intervals of Feeding:* Three small meals with three intermediate feedings.
Residue Free Diet.	Severe diarrhea to afford rest to the gastro-intestinal tract. Ulcerative colitis during initial stages of treatment. Preceding and following operations on the colon or rectum when no movement is desired for several days. Partial intestinal obstruction.	This diet is made up of foods which can be completely absorbed, thereby leaving no residue for formation of feces. Insufficient minerals and vitamins are provided; the diet should be used only for a limited time, progressing to the Bland Low Cellulose Diet.	*Foods Included:* Tender meat, fish, or fowl; clear fat free soups; fruit juices; gelatin desserts; hard cooked eggs; arrowroot cookies; rice or rice products; carbonated beverages, coffee, tea; butter and sugar in limited amounts. *Foods to Avoid:* Coarse breads and cereals; cheese; milk; rich desserts; excessive fat;

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications of the Normal Diet Necessary for Specific Disturbances	Foods to Be Included Foods to Be Avoided Intervals of Feeding
Residue Free Diet. (*Continued*)			fried foods; fruits (except juices) and vegetables; tough meats; condiments and relishes, etc.; excessive sweets. *Intervals of Feeding:* Usually three meals daily.
Bland Low Cellulose Diet.	This diet is used to prevent stimulation of peristalsis and flow of gastric juice by mechanical or chemical irritation, and to reduce inflammation. 1. Gastric and duodenal ulcers. 2. Gastritis (hyperchlorhydria). 3. Gastric atony. 4. Diarrhea. 5. Ulcerative colitis (see High Protein diet). 6. Fevers (see High Caloric Fluid and Soft diet). 7. Severe jaundice (see High Carbohydrate and High Fat diets).	This diet is adequate in nutritive essentials. Its chief modification is in consistency, and in choice of foods. Strong acids, condiments, and very hot or cold foods and drinks are omitted to prevent stimulation. Strongly flavored vegetables and legumes are omitted because they may favor gas formation and pressure. Brewer's yeast is frequently added. Small, frequent feedings are important, especially in the treatment of ulcers. Rest, relaxation, and a happy environment are essential to success of dietary treatment.	*Foods Included:* Milk, cream, butter, mild cheeses; eggs; tender meat, fish, or fowl; plain desserts; cooked and strained fruits and vegetables; strained citrus juices; fine whole-grain or enriched white bread; fine cereals; white potato, macaroni, rice, etc. *Foods to Avoid:* Coarse cereals and breads; rich cheeses; tough meats; rich desserts and pastries; raw, coarse and strongly flavored vegetables; raw fruit (except juices); excessive seasonings, pickles, relishes, etc.; strong coffee; meat extracts. *Intervals of Feeding:* Three meals daily with three intermediate feedings.

High Calorie Diet.	When it is desirable to replace lost weight. This diet is used in many conditions but especially in such diseases as hyperthyroidism which has a high metabolic rate, convalescence from fevers, and undernutrition in general.	This diet does not differ from the normal diet except in energy value. The calories may be increased to 4000-5500 daily. Reinforcing agents such as sugars, cream, and eggs are used. If digestion is poor, small servings of highly reinforced foods are given. The diet is simple, wholesome, and easily digested. This diet may be modified in consistency if the patient's condition warrants.	*Foods Included:* A regular diet with added sugar, cream, butter, eggs, etc. to increase the caloric intake. *Foods to Avoid:* Fried foods or foods having a tendency to interfere with the appetite. Excessive quantities of bulky, low caloric foods. *Intervals of Feeding:* Five to six meals daily.
High Calorie Fluid and Soft Diet.	This diet is used during acute stages of fevers — typhoid, pneumonia, tuberculosis, etc.; where there are evidences of malnutrition but the patient cannot tolerate a full soft or regular diet. Dehydration and weight loss must be combatted and corrected.	Calories are increased to 2500 or more daily; in typhoid fever 4000 to 5000 calories may be needed. Protein allowances are usually liberal — 90 Gm. or more daily. Ascorbic acid, thiamine, and vitamin A are needed in increased amounts. The fluid intake should be high, and at least 4 Gm. sodium chloride must be included daily. The diet must be soft, bland, free from fiber and irritating substances of all kinds. Small feedings at frequent intervals are advisable.	*Foods Included:* All foods on a Full Fluid diet plus: eggs in all forms except fried; fine cereals or strained whole-grain cereals; white bread; potato; strained vegetables when used in cream soups; cottage or cream cheese; plain puddings. *Foods to Avoid:* Fried foods; all vegetables except in cream soups; all fruits except citrus juices and ripe banana; all meat, fish, poultry; coarse breads and cereals; nuts; rich desserts and pastries. *Intervals of Feeding:* Usually every two hours; night feedings may be indicated.

ROUTINE HOSPITAL DIETS (*Continued*)

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications in the Normal Diet Needed for Specific Disturbances	Foods to Be Included Foods to Be Avoided Intervals of Feeding
Low Calorie Diet.	When body weight exceeds 10 per cent above average weight for height. This diet is especially important in: 1. Diabetes mellitus, when obesity serves as an obstacle in keeping the urine sugar free. 2. Cardiac and kidney disturbances where an extra burden is placed on damaged and overworked organs. 3. Hypertension. 4. Gout. 5. Gallbladder disease.	Normal diet with energy value reduced to 1200, 1000, or 800 calories. Protein levels are normal — 60 to 100 Gm. per day. Fats must be limited in order to sufficiently reduce the calories. Bulky, low carbohydrate foods, as fruits and vegetables, are used, while high carbohydrate foods — sugars, candies, cereals, breads, desserts — are contraindicated. In diets of 1000 calories or less the vitamin content is low — especially vitamin A and thiamine. Concentrates should be prescribed if diets below 1000 calories are used more than two weeks.	*Foods Included:* (1200 calorie diet) 1 pint milk. 3 teaspoons butter. 6 to 8 ounces meat, *or* 3 to 4 ounces meat plus ½ cup cottage cheese. 1 egg. 2 slices whole-grain bread, *or* 1 slice bread plus 1 serving whole-grain cereal. 1 small potato. 4 servings 3, 6, or 9 per cent vegetable. 3 servings 6, 9, or 12 per cent fruit. Coffee or tea without sugar. *Foods to Avoid:* All except those listed above; appropriate substitutions may be made. *Intervals of Feeding:* Three meals daily.
High Protein Diet.	To replace tissue and blood proteins in: 1. Nephrosis.	This is a regular diet with the protein increased to 100-150 Gm. per day. Proteins should be chosen chiefly from the complete protein group	*Foods Included:* All foods on regular diet with special emphasis on milk in all forms; eggs; cottage cheese; lean meat, fish, fowl.

High Protein Diet. *(Continued)*	2. Nephritis, if there is hypoproteinemia, but only moderate retention (see Low Salt diet). 3. Liver diseases, especially cirrhosis (see Low Fat and Low Carbohydrate diets). 4. Hyperthyroidism (see High Calorie diet).	in order to obtain optimum utilization. Calories must cover all energy needs to avoid use of protein foods for fuel; high caloric intake is needed if metabolism is increased. Salt may be restricted in the presence of edema. Fluids are sometimes also limited.	*Foods to Avoid:* If there is restriction of salt and fluid, the diet must be carefully planned as only 1 pint milk can then be used. *Intervals of Feeding:* Usually three meals with three intermediate feedings of high protein beverages.
	5. Pernicious anemia.	The protein level is kept at 100-150 Gm. daily. Fat is restricted to 70 Gm. daily. Calories, minerals, and vitamins are liberal. A soft diet is sometimes indicated.	*Foods Included:* Foods on a regular or soft diet plus 4 to 7 ounces liver daily if no liver extract is being given; fruits as peaches, apricots, strawberries, prunes, raisins, etc. are stressed. *Foods to Avoid:* Fats in excess of 70 Gm. daily; limit butter, cream, egg yolk. Avoid salad dressings, fat meats, fried foods; rich gravies; excessive seasonings, concentrated sweets. *Intervals of Feeding:* Three meals daily.
	6. Hyperinsulinism (see Low Carbohydrate diet).	120 to 140 Gm. protein daily.	
	7. Fevers, especially typhoid fever (see High Caloric Fluid and Soft diet).		
	8. Ulcerative Colitis (see Bland Low Cellulose diet).		

ROUTINE HOSPITAL DIETS (*Continued*)

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications of the Normal Diet Necessary for Specific Disturbances	Foods to Be Included Foods to Be Avoided Intervals of Feeding
High Protein Diet. **(*Continued*)**	9. Celiac disease which is characterized by intolerance for carbohydrates and fats.	This diet is high in protein but low in poorly tolerated fats and carbohydrates. Protein foods become an important source of energy. The diet is usually given in three or more stages. The diet should be reinforced with vitamin concentrates.	*Foods Included:* Skimmed milk, buttermilk, protein milk, skimmed-milk cottage cheese, egg white (later, whole egg), tender lean meat, banana, citrus juices. Gradually added: low carbohydrate cooked and strained fruits and vegetables; zwieback. *Foods to Avoid:* Sugars and sugar products as jelly, jam, candy, pastry, cake, starchy foods, bread, cereals. Fats as butter, butter substitutes, bacon, fat meat, peanut butter, salad oils, cream. *Intervals of Feeding:* Adjusted according to stage of disease, age, and condition of patient.
Moderately Low Protein Diet.	Whenever there is marked retention of nitrogen, as in severe nephritis with uremia (see Low Salt diet).	Protein is usually restricted to 50 Gm. per day. Only protein foods of high biological value should be used. Carbohydrates are usually liberal.	*Foods Included:* 2 glasses milk. 2 eggs or 1 egg plus 2 ounces meat, fish, or fowl. 3 slices bread.

Moderately Low Protein Diet. ***(Continued)***		Calories are adequate for maintenance; energy should be derived from carbohydrates and fats so that the burning of protein foods or of body tissues is avoided. Salt is restricted to less than 2 Gm. Fluids may be restricted to 1000 cc. or even less. Depending upon the condition of the patient, this diet may be of soft or regular consistency. A liquid diet is sometimes indicated. Only bland, easily digested foods should be allowed. Because this diet is easily apt to be inadequate, it should not be continued for long periods of time.	2 servings cereal (including macaroni, rice, etc.). 1 potato. 2 servings vegetables. 2 servings fruits. 1 ounce butter. *Foods to Avoid:* In excess of amounts stated above: meat, fish, fowl; eggs; milk; bread; cereal. Avoid entirely: legumes; nuts; gelatin; salty foods; highly seasoned foods; pastries. *Intervals of Feeding:* Three meals daily; sometimes six small feedings are preferable.
High Carbohydrate Diet.	Toxemias of pregnancy. Liver and gallbladder disturbances (see also Low Fat and High Protein diets). Cardiac disturbances (see Low Salt diet).	Adequate diet with increased carbohydrate content. Other modifications depend upon the condition for which it is to be used; it may be a high carbohydrate low fat high protein diet for treatment of liver diseases, or a high carbohydrate low salt bland diet for cardiac disturbances.	*Foods Included:* High carbohydrate foods: fruits and vegetables which are high in carbohydrate; simple starchy puddings; fine cereals; white and wholewheat bread; fruit desserts and jellies; glucose, sucrose, syrups. Milk, eggs, lean meat, fish or fowl, and butter used as necessary for adequate nutrition. *Foods to Avoid:* Fried foods, condiments, spices, alcoholic beverages, usually all rich and fatty foods.

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications of the Normal Diet Necessary for Specific Disturbances	Foods to Be Included Foods to Be Avoided Intervals of Feeding
High Carbohydrate Diet. *(Continued)*			*Intervals of Feeding:* Depends on condition, but usually three meals with three intermediate feedings.
Moderate to Low Carbohydrate Diet.	Epilepsy (see High Fat diet). Obesity (see Low Calorie diet). Celiac disease (see High Protein diet). Hyperinsulinism (see also High Protein diet). Diabetes mellitus.	The diets for diabetes mellitus, hyperinsulinism, and epilepsy are calculated for the individual nutritional needs. A diabetic diet usually allows 100 to 250 Gm. of carbohydrate depending upon the individual and upon the regimen being used. A ketogenic diet contains less than 30 Gm. carbohydrate as a rule, while the diet for hyperinsulinism allows not more than 120 Gm. carbohydrate daily. The diet for celiac disease is severely restricted in carbohydrate.	*Foods Included:* Milk, eggs, butter, meat, fish, poultry, low carbohydrate fruits and vegetables, small amounts of bread and cereals, depending upon the condition being treated. *Foods to Limit or to Avoid:* Cereals, including rice, macaroni, etc.; bread; sugar, candy, jellies; cake, cookies, starchy or sweet desserts. *Intervals of Feeding:* Varies with the age and type of disturbance; usually three meals.
High Fat Diet.	To produce an acidosis: 1. Epilepsy for alleviation of seizures. 2. Pyelitis for bactericidal effect. 3. Certain types of migraine. 4. Asthma, occasionally.	Protein is limited to $\frac{2}{3}$ to 1 Gm. per kilogram of body weight. Carbohydrates are restricted to less than 30 Gm. per day, but not less than 10 Gm.	*Foods Included:* Cream (40 per cent); butter; bacon; salad oils and salad dressings; meat, eggs, cheese; small amounts of low carbohydrate fruits and vegetables.

High Fat Diet. *(Continued)*		Sufficient fat is provided for adequate energy, and to effect a state of ketosis. The diet must be calculated for each patient, and the daily food allowances must be weighed. The diet is low in calcium, iron, and the water soluble vitamins. These factors should be supplied in the form of concentrates. Fluids are usually restricted. This diet is a difficult one to use from day to day and careful supervision is necessary.	Cellu bran wafers may be used for bulk. *Foods to Avoid:* Breads and cereals; desserts; sugar, candy, syrups and all sweets; cakes, cookies, pastries; fruits and vegetables high in carbohydrate. *Intervals of Feeding:* Three meals of equal carbohydrate, fat, and protein content.
Low Fat Diet.	Liver and gallbladder disturbances (see also High Carbohydrate and High Protein diets). Obesity (see Low Calorie diet). Celiac disease (see High Protein diet). Intestinal disturbances when membranes show a sensitivity to fatty acids (see Bland Low Cellulose diet).	An adequate diet with fats restricted to 45 Gm. daily is given. Fats may be restricted to 25 Gm. per day; even greater restrictions are necessary in celiac disease. When used for liver and gallbladder disease, this diet is also high in carbohydrate and protein. Fat soluble vitamin concentrates must be supplied when butter and whole milk are omitted. Green vegetables should not be relied upon for vitamin A in liver diseases, since there may be inability of the liver to convert carotene to vitamin A.	*Foods Included:* In limited amounts: 1 pint milk. 1 egg. 3-6 ounces lean meat. 3 teaspoons butter. If 25 Gm. of fat or less are allowed, only skim milk may be used; butter is then omitted. As desired: skim milk; skimmed-milk cottage cheese; egg white; whole grain bread and cereals; fruits; vegetables. *Foods to Avoid:* Fats (except as allowed above); fatty meat; gravies; salad dressings; rich

ROUTINE HOSPITAL DIETS (*Continued*)

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications of the Normal Diet Necessary for Specific Disturbances	Foods to Be Included Foods to Be Avoided Intervals of Feeding
Low Fat Diet. *(Continued)*		Bland, easily digested foods must be given. A soft diet is frequently necessary.	desserts, pastries; fried foods; strongly flavored vegetables; excessive seasoning; nuts; ice cream; chocolate; legumes.
Low Salt Diet (Salt Poor Diet).	To prevent the formation of edema fluid: 1. Nephritis (see High Protein diet). 2. Nephrosis (see High Protein diet). 3. Cardiac disease.	This is a normal diet with limited salt content. If 2 Gm. of sodium chloride are allowed daily, the food must be prepared without salt and only 1 pint of milk can be allowed. Fluids are often restricted to 1200 cc. or less per day. In nephritis, some physicians may order that fluids be forced. The protein content should be sufficient for maintenance and repair. A liberal allowance of easily digested carbohydrate is indicated in cardiac disease. Bland, easily digested foods must be selected. A soft diet which progresses gradually to a regular diet is indicated in severe conditions.	*Foods Included:* Milk (1 pint only); meat, fish, or fowl; eggs; potato; mild vegetables; fruits; whole-grain cereals; salt poor bread; unsalted butter; plain desserts. *Foods to Avoid:* Fried foods; rich pastries; strongly flavored vegetables; all salted foods, noting especially canned and smoked fish, pickles, relishes, salted butter, salted nuts, potato chips, canned salted vegetables. *Intervals of Feeding:* Three small meals with three intermediate feedings, progressing to three moderate meals per day.

Acid Ash Diet.	To adjust the reaction of the urine so that salts are held in solution: Kidney stones — calcium and magnesium phosphates, carbonates, and oxalates.	This diet, when carefully planned, meets the requirements for normal nutrition. Acid ash foods are emphasized — flesh foods, eggs, cereals, etc. Fruits and vegetables are chosen from those which yield the least alkaline ash. Neutral foods may be used as desired. All food is prepared and eaten without salt. The diet should be high in vitamin A; supplements are usually prescribed.	*Foods Included:* Large servings of meat, fish, poultry, eggs, whole-grain cereals, soda crackers, bread, cake, rice, macaroni, noodles, corn, plums, prunes, cranberries. Limited amounts: 1 pint milk. 2 servings vegetables. 2 servings fruit. Neutral foods as desired: butter, sugar, plain candies, tapioca, oils and fat, coffee, tea. *Foods to Avoid:* Legumes, spinach, greens, dried fruits, molasses, olives, parsnips, salty foods as canned fish and canned vegetables, salted nuts, catsup, relishes. *Intervals of Feeding:* Three meals daily.
Alkaline Ash Diet.	To adjust the reaction of the urine so that salts are held in solution: Kidney stones—uric acid and cystine calculi.	This diet meets the requirements of normal nutrition. Alkaline ash foods as fruits, vegetables, and milk are emphasized. Acid-ash foods are limited to those necessary for good nutrition. Neutral foods may be used as desired. The diet should be high in vitamin A; concentrates are usually prescribed.	*Foods Included:* Large amounts of fruits, vegetables, milk. Limited amounts: 2 ounces meat. 1 egg. 1 serving cereal. 1 to 2 slices bread. As desired: butter, sugar, oils and fats.

Type of Diet	Indications for Use of Diet and Pathological Conditions for Which the Type Diet Is Used	Characteristics of the Diet and Modifications of the Normal Diet Necessary for Specific Disturbances	Foods to Be Included Foods to Be Avoided Intervals of Feeding
Alkaline Ash Diet. *(Continued)*			*Foods to Avoid or Limit:* Meat, fish, fowl; eggs; cheese; prunes, plums, cranberries, corn; breakfast cereals, macaroni, rice; cakes, cookies, crackers. *Intervals of Feeding:* Three meals daily.
Low Purine Diet.	Gout.	This is usually a normal diet with restriction of foods containing purine. The amount of fat is limited because fats interfere with the excretion of urates. Whenever obesity is present, a low calorie diet is necessary (see Low Calorie diet).	*Foods Included:* Milk, eggs, refined cereals and white bread, potato, vegetables (note exceptions), fruits, butter in moderation. *Foods to Avoid:* Meat extracts, bouillon, gravies; meats, especially organ meats; fish; whole-grain cereals and bread; legumes; spinach, watercress, lima beans, cabbage, asparagus, onions, kohlrabi; excessive seasoning; relishes; alcoholic beverages. *Foods Used Occasionally:* Bacon (well cooked), oysters, crab, lobsters, lamb, fresh salmon, chicken, whitefish, haddock. *Intervals of Feeding:* Three meals daily.

High Vitamin Diet.	Pernicious anemia, hyperthyroidism, malnutrition, pregnancy, and lactation. *Increased vitamin A* — night-blindness, xerophthalmia, gastro-intestinal disturbances, to build normal mucous membranes. *Increased thiamine* — beriberi, gastro-intestinal and nervous disturbances. *Increased niacin* — pellagra, gastro-intestinal disturbances. *Increased riboflavin* — cheilosis, skin disturbances, gastro-intestinal disorders. *Increased ascorbic acid* — scurvy, dental caries. *Increased vitamin D* — rickets, osteomalacia, dental caries.	A well balanced diet which is high in vitamins from foods and concentrates is indicated. It is not practical to supply sufficient vitamins from natural foods in the treatment of severe deficiency diseases; supplements should be prescribed.	*Foods Included:* Liberal amounts of milk, eggs, butter; meat (especially liver and pork); whole-grain cereals and breads; citrus fruits; other fruits; green leafy and yellow vegetables. *Vitamin Formula*:* 10 mg. thiamine. 50 mg. niacin. 5 mg. riboflavin 75 mg. ascorbic acid. *Supplements for Specific Deficiencies*:* Beriberi: 10 mg. thiamine. Ariboflavinosis: 5 mg. riboflavin, b.i.d. Scurvy: 100 mg. ascorbic acid, t.i.d. Mild pellagra: 50 mg. niacin amide, t.i.d. Severe pellagra: 150 mg. niacin amide, t.i.d. Mild rickets: 1600 I.U. vitamin D from fish oils or irradiated ergosterol. Advanced rickets: 5000 I.U. vitamin D daily. Refractory rickets: 50,000 I.U. vitamin D daily. The above supplements are always prescribed by the physician, if they are to be used.

*Spies, T. D.: Principles of Diet in the Treatment of Disease, *Handbook of Nutrition*, Chicago: American Medical Association, 1943.

CHAPTER XX

Diet in Deficiency Diseases

The recognition of food as a remedial agent is not a new discovery. Hippocrates, the so-called Father of Medicine, called attention to this fact many centuries ago, but it is only within recent years that the real significance of food as a factor for health and a preventive of certain types of disease has been given recognition. Today nutrition has taken its place with the other sciences, and the medical world is finding its true value as a factor in the treatment of disease and the prevention of deficiencies which ultimately lead to disease.

The body requires certain specific nutrients, not only to be able to carry on its normal work but to actually exist. When one or more of these essential factors are lacking or are deficient in the diet, certain symptoms occur indicating the development of some disturbance. Malnutrition is not an uncommon condition. Surveys made in the United States and in other parts of the world make this an unquestioned fact. Day by day research is proving that the condition is caused, not by the lack of one factor alone, but by a combination of deficiencies one of which predominates.

It is known that respiration and growth of cells necessitates the synthesis of complex substances from simpler compounds. When there is a deficiency of these simple substances to meet the needs of the body, whether it is because the intake of food is not properly assimilated or whether it is because the demands of the body and proportionate losses are greatly increased, certain disturbances occur. For a time the conditions are taken care of by specific mechanisms which the body seems to have for the purpose. These mechanisms are very efficient, but after a time they begin to fail in their work, and the odds are against them, especially if the conditions are prolonged. It is then that the real disturbance manifests itself. In the presence of fever, acute infections, and extreme exercise, the mecha-

nisms are further handicapped and the conditions are magnified in proportion to their power.[1]

The intelligent study of the deficiency diseases presupposes a thorough familiarity with the nutrients comprising the normal diet, and it is suggested that the student review carefully the chapters on the vitamins especially (Chapters VII and VIII). A conscientious reading of the excellent reviews by Spies,[1] Kruse,[2] Jolliffe,[3] and Sebrell[4] in the *Handbook of Nutrition* will prove to be invaluable to the serious student of deficiency diseases.

Occurrence of Deficiency Diseases. Deficiency diseases may be mild or severe in character, and acute or chronic in type. "The classic deficiency disease represents the severe acute stage."[2] In the acute stage the disease processes are likely to progress rapidly and yield to treatment promptly. If the deficiency is mild the progress is not so rapid. Chronic deficiencies not only progress more slowly, but also respond to treatment much more slowly.

Acute deficiencies have been recognized widely, but the chronic state has been more or less overlooked. Time is the keynote in the chronic deficiency diseases. The living of a long life provides ample opportunity for tissue changes; hence, these changes may occur more frequently and in more advanced stages as age advances. In an earlier chapter (Feeding the Aged, Chapter XVIII) the changes due to increasing age have been discussed, but time, not senility, is the essential factor.

Children are more prone to develop acute deficiencies than adults, but children are not immune to chronic deficiencies. Malnutrition due to a grossly deficient diet during the prenatal period frequently leads to deficiencies in both the mother and the infant — more often in the infant than in the mother. Elderly individuals develop deficiencies of a chronic type when their diets have been moderately inadequate over a long period of time.

There are a number of tests used in determining the existence and the state of deficiencies in human subjects. These include analysis of the blood plasma and urine, x-ray studies, and the use of specific instruments designed for the purpose — the biophotometer for light adaptation, for example. The type and stage of deficiency disease may thereby be revealed, but since these tests are primarily medical procedures they will not be discussed here.

Some Causes for Deficiency Diseases. The causes for deficiency diseases are so numerous that it would be impossible to mention all of them in this discussion. However, some of them are listed here, and others will no doubt suggest themselves.

1. Bad food habits including insufficient food resulting from (a) poverty, or (b) ignorance, or both. Foods containing the essential nutrients are omitted from the diet. Too much of one type of food and too little of another (unbalanced diet) may be taken.

2. Gastro-intestinal disturbances which interfere with the digestion, absorption, and utilization of the essential nutrients:

   a. Achlorhydria which may impair absorption of thiamine and ascorbic acid

   b. Diarrhea which carries out of the body the necessary vitamins, minerals and other nutrients so that severe deficiencies may develop which result in pellagra, beriberi, scurvy, nutritional edema, hypocalcemia, etc.

3. Chronic alcoholism, a known factor in the development of deficiency disturbances, may impair various organs of the body so that utilization of the nutrients is interfered with — the liver, for example.

4. Hypothyroidism. Abnormal dark adaptation may possibly be caused in part by failure of the thyroid hormone to function in the conversion of carotene to vitamin A.[3]

5. Organic disturbances such as tuberculosis, diseases of the cardio-vascular system, of the gastro-intestinal system, the kidneys, and diabetes all have a tendency to interfere with the appetite, the digestion, absorption, and utilization of food.[1] "Gastro-intestinal and neuropsychiatric disorders, food allergy and the nausea of pregnancy are noted for their interference with food intake, and literature is replete with references to deficiency diseases developing under such conditions" (Jolliffe)[3].

6. Faulty therapeutic measures in which the diet is inadequate because of:

   a. Needless restriction of the nutrients in overzealousness to treat a disease condition

   b. Increased body metabolism without a corresponding increase in the nutrients.

Recognized Deficiency Diseases. The more well known deficiency diseases include:

1. Xerophthalmia and night blindness caused by a deficiency of vitamin A
2. Beriberi, a nervous disease due to a deficiency of vitamin B_1 (thiamine)
3. Ariboflavinosis or cheilosis resulting from deficiency of riboflavin
4. Pellagra due to lack of niacin and possibly other members of the B complex
5. Scurvy caused by a deficiency of vitamin C (ascorbic acid)
6. Rickets, osteomalacia, or tetany which occurs as a result of vitamin D lack and impairment of calcium metabolism
7. Simple goiter which is occasioned by lack of iodine
8. Nutritional edema due to deficiency of protein of high biological value
9. Nutritional anemia (see Chapter XXXIII)
10. Sprue, of unknown etiology, but believed to develop more frequently when the body is malnourished or suffering from infection.

Characteristic Deficiency Symptoms. These are:

1. Loss of interest and desire for food, causing loss of weight
2. Difficulty in concentration, and a progressive loss of interest in affairs formerly considered important
3. Swollen congested eyelids, dry surface of the eye itself resulting from impairment of the lacrymal glands and the secretions therefrom and leading to infections of the eye, itching and burning sensations of the eye
4. Difficulty in seeing in a dim light especially after leaving a brightly lighted room
5. Sore, painful muscles and joints, muscular weakness, and inability to coordinate
6. Sore mouth and tongue, dermatitis, and other skin disturbances
7. Glossitis, gastro-intestinal disturbances, including diarrhea or constipation

8. Bone deformities, especially of the long bones, the bones of the chest, spine, and pelvis; multiple fractures due to fragility of the bones
9. Cheilosis—lesions at angles of the mouth and extending into the face with frequent eruptions occurring about the nose
10. Impairment in the nervous system and neuromuscular system; nervousness and irritability.

The Diet in Deficiency Diseases. The keynote for treatment of any deficiency disease lies in the early recognition of symptoms. Malnutrition is subtle in its development, and may be present for a long time before it is recognized. Thus, mild deficiencies are frequently overlooked and, not until the condition is well advanced and the disturbance traceable to malnutrition becomes acute, is the treatment begun.

Diet alone is not always the sole factor to be considered. The already mentioned disturbances in digestion, absorption, and utilization of food may interfere with the body's use of even the most completely adequate diet. It is the physician who recognizes and correlates all the causes and institutes treatment for the existing pathological condition.

The diet used in the treatment of deficiency diseases is a normal one which is adequate in every respect. Vitamins, minerals, and frequently protein are provided in amounts larger than those recommended by the Food and Nutrition Committee of the National Research Council for normal persons. The "High Vitamin" or "High Vitamin, High Caloric, High Protein" diets serve as key diets for the treatment of all deficiency diseases. In recognized deficiency diseases recovery is much more prompt if the diet is supplemented with vitamin concentrates and liver extract or its equivalent; in fact, such supplementation is sometimes imperative.

The following diets are typical of those used in the treatment of specific deficiencies:

HIGH VITAMIN DIET[5]

General rules:

The normal diet is supplemented with foods rich in vitamins.

For specific deficiency conditions the factors responsible for the condition must be considered and the necessary nutrients added in the form of concentrates by mouth or by injection.

If an increased intake of vitamin D is necessary, cod liver oil or vitamin D concentrate should be prescribed since natural foods are relatively poor in this vitamin.

Include these foods daily:

1 quart milk
1 serving (3 ounces) meat, fish, or fowl; liver or pork twice a week
3 eggs or 2 eggs and a substitute of meat, fish, or cheese
6 servings (4 tablespoons) butter.
3 servings fruit — one to be orange, grapefruit, or tomato juice (½ glass)
4 servings vegetables in addition to 1 or more servings of potato, corn, or dried beans
  1 to be green or yellow
  1 to be uncooked
  1 to be tomatoes or tomato juice
3 servings whole-grain cereal or whole-grain bread
Other foods to provide adequate calories

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Preserved figs
Cereal with milk and sugar	Wheatena with milk and sugar
Egg with butter	Scrambled egg with butter
Whole-grain bread with butter	Graham-bread toast with butter
Beverage with cream and sugar	Coffee with cream and sugar
Midmorning	
Citrus juice — ½ glass	Orange juice — ½ glass
Luncheon or supper	
Egg or a substitute of cheese, meat, or fish	Macaroni and cheese
Potato, rice, noodles, spaghetti, or macaroni with butter	
Vegetable, yellow or green	Buttered peas
Salad	Mixed green salad with French dressing
Whole-grain bread with butter	Wholewheat bread with butter
Fruit	Fresh strawberries
Milk	Milk
Midafternoon	
Milk beverage	Chocolate milk

HIGH VITAMIN DIET[5] *(Continued)*

TYPE DIET	SAMPLE MENU
Dinner	
Tomato juice — ½ glass	Tomato juice — ½ glass
Meat, fish or fowl	Sautéed liver with onion sauce
Potato with butter	Mashed potato with butter
Vegetable	Buttered green beans
Whole-grain bread with butter	Graham roll with butter
Dessert	Apricot soufflé
Milk	Milk
Evening nourishment	
Eggnog	Eggnog, vanilla flavored

When there has been a great loss of weight and it is necessary to increase the caloric and protein intakes more than provided in the preceding diet the following plan may be effective.

HIGH VITAMIN, HIGH CALORIC, HIGH PROTEIN DIET

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Half grapefruit
Whole-grain cereal with milk and sugar	Cooked Ralstons with milk and sugar
Eggs — 2	Poached eggs — 2
Whole-grain bread — 2 slices with 3 teaspoons butter, and jelly or marmalade	Wholewheat toast — 2 slices with butter and grape jelly
Beverage	Coffee with cream and sugar
Midmorning	
Citrus fruit juice with cerelose	Orange juice with 1 tablespoon cerelose
Luncheon or supper	
Cream soup, 1 teaspoon butter	Asparagus soup with butter
Meat, fish, cheese, or egg — large serving	Creamed chipped beef on Melba toast
Potato or substitute	Baked potato with butter
Vegetable — yellow or green, with butter	Buttered spinach
Salad with dressing	Cottage cheese on lettuce; French dressing
Whole-grain bread — 2 slices with 3 teaspoons butter and jam	Wholewheat bread with butter and strawberry jam

TYPE DIET	SAMPLE MENU
Fruit	Baked apple with cream
Milk and cream ($\frac{1}{2}$ glass milk and $\frac{1}{2}$ glass coffee cream)	Milk and cream — 1 glass
Midafternoon	
High caloric beverage made with milk and cream	Malted milk
Dinner	
Tomato juice — $\frac{1}{2}$ glass	Tomato juice — $\frac{1}{2}$ glass
Meat, fish, or fowl — large serving	Roast lamb — 4 ounces cooked
Potato with butter	Potatoes au gratin
Vegetable with butter	Broccoli with butter
Whole-grain bread with butter	Wholewheat rolls — 2 with 3 teaspoons butter
Dessert	Peppermint candy ice cream with chocolate sauce
Milk and cream ($\frac{1}{2}$ milk and $\frac{1}{2}$ coffee cream)	Milk and cream — 1 glass
Evening nourishment	
High caloric beverage	High caloric eggnog
Sandwich, crackers, or cake	Sandwich with peanut butter-yeast spread*

* The spread consists of 4 parts peanut butter, and 1 part brewer's yeast mixed with 1 tablespoon jelly. It is an excellent source of calories, protein, minerals and vitamins.

The Use of Vitamin Concentrates in Deficiency Diseases. The vitamin content of the high-vitamin diet in itself is usually not sufficient for effective treatment of severe deficiency diseases. The following formula has been used effectively by Dr. Spies[1] in conjunction with dietary treatment:

10 mg. thiamine
50 mg. niacin
5 mg. riboflavin
75 mg. ascorbic acid

These vitamins are given daily in general deficiency states and are further supplemented with specific factors as one or another deficiency predominates (see discussion to follow on specific diseases).

SPECIFIC DEFICIENCY DISEASES

XEROPHTHALMIA AND NIGHT BLINDNESS

Xerophthalmia is a severe disease of the eye occurring infrequently in this country but commonly seen where malnutrition is severe. Night blindness, on the other hand, is a much too common finding among all people. Both are manifestations of vitamin A deficiency.

Pathological Conditions. When vitamin A deficiency occurs the eyelids becomes congested and swollen. The eye and the eyelids become dry and inflamed due to an impairment of the lacrymal glands whose function it is to secrete a fluid which washes away the bacteria and other foreign agents. The inflammation progresses so that the eye closes completely, and untreated xerophthalmia may cause permanent blindness.

Courtesy of Dr. L. J. Harris, "Vitamins," The Cambridge University Press

FIG. 20. XEROPHTHALMIA

An eye trouble caused by deficiency of Vitamin A. The cause of thousands of cases of blindness annually in India.

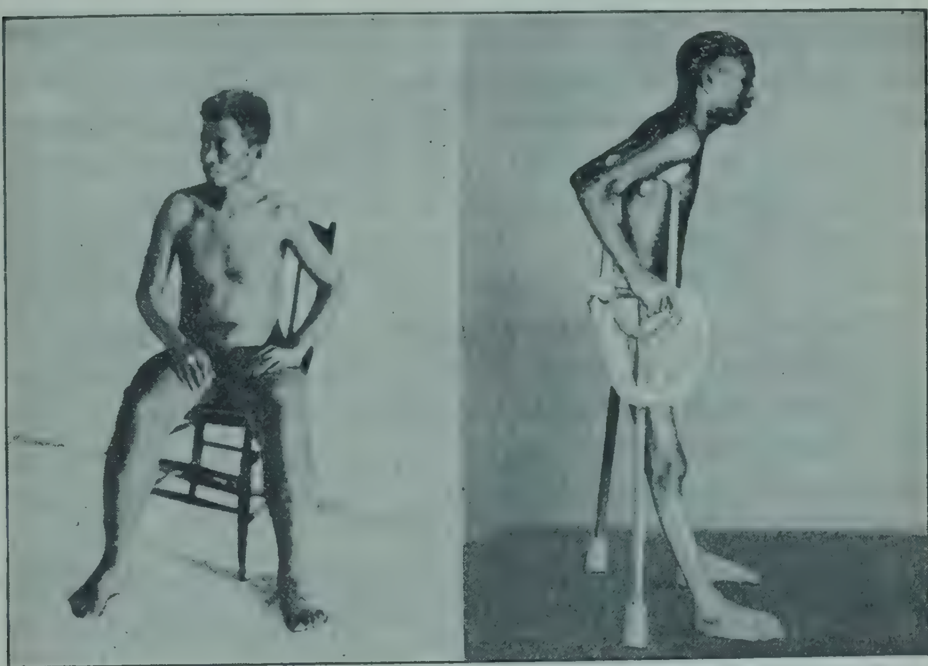
Night blindness (Nyctalopia) is a condition in which the individual suffers a diminished ability to see well in dim light, especially on coming into darkness from a bright light. The defect in vision is attributed to a degeneration of the visual purple of the eye. Prompt regeneration of the visual purple is necessary to overcome

this condition. Vitamin A has a very fundamental role in the regeneration of the visual purple in the retina after it has been bleached by bright light.

Treatment. The diet used in the treatment of xerophthalmia or of night blindness is the high vitamin diet (page 272) with supplementary vitamin A. A daily intake of 50,000 I.U. for at least 2 months is recommended.[1] Such supplementation of the diet must be prescribed by the physician.

BERIBERI

Beriberi is a nervous disease which is attributed chiefly to a deficiency of vitamin B_1 or thiamine. Vitamin B_1 has been recognized for years as a fundamental cause of damage to both nervous and cardiovascular systems, this damage leading inevitably to beriberi.



Courtesy of Dr. George B. Cowgill, New Haven

FIG. 21*a*. FIG. 21*b*.
"WET" BERIBERI AND "DRY" BERIBERI
(Herzog) (Baltz and Miura)

Pathological Conditions. There are two recognized types of beriberi, the "dry" type and the "wet" type. The outstanding symptom of the wet type is edema, while that of the dry type is extreme emaciation. The dry type of beriberi with its multiple neuritic

symptoms is more common in the United States, but the wet type occurs occasionally in some parts of the country.

The disease beriberi is characterized by the following symptoms:

1. Gastro-intestinal disturbances resulting primarily from impairment of the motor processes throughout the gastro-intestinal tract;

2. Muscular weakness or paralysis of the lower limbs caused by multiple neuritic conditions;

3. Degenerative changes in the heart muscles;

4. Edema in the wet type, or extreme emaciation in the dry type. Both types show the characteristic muscle and neuromuscular weakness. Mild and chronic cases of beriberi are likely to be overlooked until the disabling weakness or paralysis in the limbs develops.

Mild Thiamine Deficiency. If the amount of thiamine available to the body is only slightly below that which is necessary, beriberi in its classic forms may not be present. However, the individual who is deprived of small amounts of vitamin B_1 daily builds up an increasing deficiency state which may be characterized first by fatigue, irritability, nervousness, depression, loss of appetite, and lack of interest in his affairs. As the deficiency becomes more marked the patient may complain of gastro-intestinal disturbances and loss of weight. It is the mild but chronic deficiency of thiamine which is more difficult to diagnose.

Treatment. The treatment of beriberi is chiefly dietary. The diet must be adequate in every respect and additional vitamins are administered daily in order to overcome the acute symptoms. The basic "Vitamin Formula" (page 275) plus 10 mg. of thiamine daily is used in conjunction with the high vitamin or high vitamin high caloric high protein diet (page 274).

Factors Affecting the Thiamine Available to the Body. Certain factors adversely affect the quantity of thiamine which is available to the body.

1. Refining processes deprive grains of the outer layers of bran and of the germ and remove most of the vitamin B_1. Whole-grain products or enriched flour should be used whenever possible.

2. Thiamine, like other members of the B complex, is soluble in water. Long soaking or cooking in large amounts of water removes a considerable portion of the vitamin. If the water used in cooking the food is used in the diet such loss is minimized.

3. The addition of alkalies (baking soda) to the water in which vegetables are cooked destroys the thiamine and other B vitamins contained in the food.

4. Digestive disturbances accompanied by vomiting and diarrhea result in a great loss of vitamin B_1 from the body.

5. The intake of thiamine may seem to be adequate, but if carbohydrates are eaten in excess deficiency may result. The need for thiamine parallels the carbohydrate intake.

6. Chronic alcoholism is an important factor in the development of thiamine deficiency and subsequent neuritis and beriberi.

It is evident that one must consider not only the selection of foods which supply adequate thiamine, but one must so prepare these foods that the maximum thiamine is retained. All of the above factors must be kept in mind and each patient carefully instructed.

PELLAGRA

Pellagra is a deficiency disease in which the gastro-intestinal tract, the skin, and the nervous system are all involved. Deficiency of nicotinic acid is specially responsible for the development of pellagra, but it is likely that all members of the B complex are concerned.

Pathological Conditions. The following characteristic symptoms occur in pellagra:

1. Sore tongue and throat, and glossitis extending throughout the gastro-intestinal tract;

2. A characteristic dermatitis especially on the exposed surfaces of the body (hands, arms, legs, feet); sensitivity of skin to strong sunlight;

3. Nausea, vomiting, and severe diarrhea;

4. Deficiency of hydrochloric acid in the gastric juice;

5. Anemia;

6. Loss of vigor, loss of weight, general weakness, and possible ataxia;

7. Neurological symptoms which may be mild in the beginning but are likely to progress in severity until in some cases the late stages of dementia are present.

Pellagra may be acute or chronic in form. During the acute stage the mouth, tongue, and throat become bright red and very sore,

Fig. 22. Dermatitis in Pellagra
Patient in Duke Hospital, Durham, N. C.

making it difficult and painful to eat and swallow. The appetite becomes greatly decreased and loss of weight follows the lowered food intake. The nose becomes irritated and shows the same type of inflammatory condition as seen in the tongue and mouth. Frequent lesions develop in the corners of the mouth with extension of the fissures into the face rather than into the mouth; these lesions are now recognized as a separate disturbance caused by riboflavin lack. Nausea and vomiting are common symptoms of the acute stage of pellagra, and severe diarrhea occurs as a result of the extreme irritation and inflammation of the intestinal tract. The anemia developing in pellagra is like that of pernicious anemia.

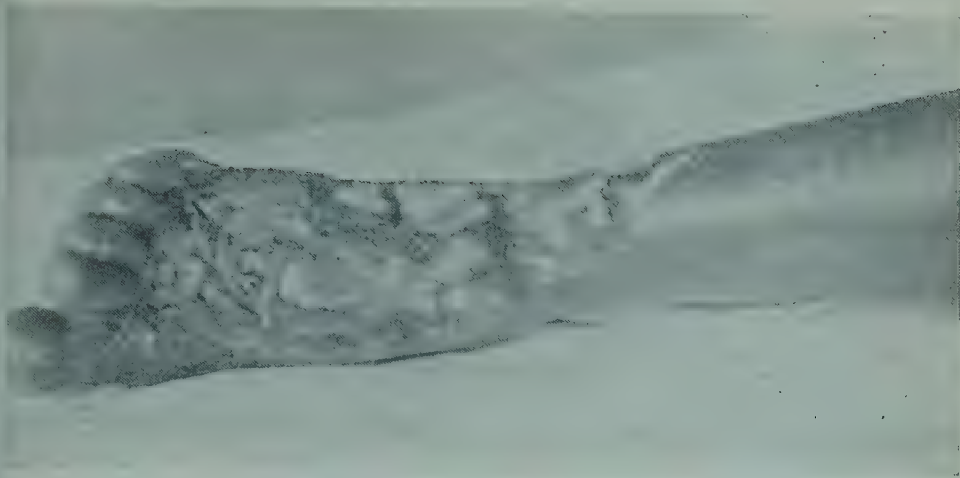


FIG. 23. DERMATITIS IN PELLAGRA
Patient in Duke Hospital, Durham, N. C.

Pellagra which is more prevalent in the Southeastern states is not entirely confined to that region. Typical cases of pellagra frequently develop in chronic alcohol addicts. Chronic pellagra occurs in some parts of the South, whole families showing symptoms of the disease. Pellagra was at one time believed to be contagious since more than one member of a family developed the typical symptoms. However, investigations have shown that all affected members of the family ate the same deficient diet — inadequate not only in niacin, but in all members of the B complex.

Treatment. The frequently heard statement "Once a pellagrin always a pellagrin" is a fallacy. Careful and persistent treatment, especially of chronic cases of pellagra, with proper education of the patient in what to eat and how much of the essential foods are necessary should prevent a recurrence of the disease.

It must be remembered that during the acute stage the severe inflammatory condition of the mouth makes it impossible to administer solids of any kind. As a rule, with treatment by massive doses of niacin by mouth or parenterally, it is possible to progress the diet quickly from an all-fluid diet to a soft diet. The chief characteristic of the diet, whether liquid or soft, is its high vitamin content, but it should be noted that the caloric and protein values are also exceptionally high.

Physicians usually give niacin in addition to the high vitamin diet. The basic "Vitamin Formula" plus 50 mg. niacin amide t.i.d.

for mild cases of pellagra, or 150 mg. niacin amide t.i.d. for severe cases is recommended.[1] There are times when it is not possible to obtain pure niacin in sufficient quantities, in which case it is necessary to supply the vitamin from some other source. Brewer's yeast is very satisfactory. The following fluid and soft diets may be used when brewer's yeast is the source of the vitamin.

HIGH VITAMIN FLUID DIET[6]

(For Pellagra)

Include these foods daily:

2 quarts milk
2 eggs
1 cup 18 per cent cream
2 cups orange juice
3 cups tomato juice
$\frac{1}{4}$ cup vegetable purée for soup
1 tablespoon flour for cream soup
1 cup broth
2 tablespoons butter
6 to 9 tablespoons brewer's yeast
1 tablespoon wheat cereal (measured dry)
1 serving plain dessert: jello, ice cream, soft custard
4 tablespoons chocolate syrup

SAMPLE MENU

7.00 A.M.	Milk and cream, flavored with coffee if desired
8.00 A.M.	Orange juice — 1 cup
9:30 A.M.	Chocolate eggnog — 1 large glass (Recipe on page 283)
11.00 A.M.	Tomato juice with brewer's yeast — 1 large glass (See recipe on page 283)
12.30 P.M.	Cream soup — 2 cups Ice cream — 1 serving
2.00 P.M.	Orange juice — 1 cup
3.30 P.M.	Chocolate eggnog — 1 large glass
5.30 P.M.	Cream soup — 2 cups Soft custard — 1 serving
7.30 P.M.	Tomato juice with brewer's yeast — 1 large glass (360 cc.)
9.30 P.M.	Gruel with beef broth — 1 cup Jello — 1 serving

Recipes using brewer's yeast

Chocolate Eggnog

1 cup milk
2 tablespoons chocolate syrup
1 tablespoon brewer's yeast
1 egg
Additional sugar, if desired

Tomato Juice with Yeast

7 ounces tomato juice
1 to 2 tablespoons brewer's yeast

Peanut Butter Spread

4 tablespoons peanut butter
2 tablespoons jelly
1½ tablespoons brewer's yeast

Peanut Butter Ice Cream

1½ cups evaporated milk
1½ tablespoons flour
⅓ cup sugar
4 tablespoons peanut butter
4 tablespoons brewer's yeast
Mix and freeze as any ice cream

HIGH VITAMIN SOFT DIET[6]

(For Pellagra)

Include these foods daily:

6 cups milk
4 eggs
½ cup 18 per cent cream
1⅓ cups tomato juice (14 ounces)
2 to 3 ounces scraped beef or ground liver
½ to ⅔ cup cottage cheese
4 tablespoons peanut butter
7 to 9 tablespoons brewer's yeast
2 tablespoons butter
5 slices whole-grain bread
½ cup cooked cereal — fine or strained whole grain
4 servings vegetable pureé—green and yellow vegetables
2 servings potato
2 servings fruit purée
1 serving peanut butter ice cream
4 tablespoons chocolate syrup
2 tablespoons jelly

SAMPLE MENU

Breakfast

Strained fruit
Cereal with cream and sugar
Soft cooked eggs — 2 with butter
Toast, buttered — 1 slice
Coffee, if desired

Midmorning

Chocolate eggnog with added yeast

HIGH VITAMIN SOFT DIET[6] *(Continued)*

SAMPLE MENU

Luncheon or supper

Tomato juice with yeast
Scraped beef patty
Mashed potato
Vegetable purée — strained carrots
Peanut butter ice cream
Bread with butter — 1 slice
Milk — 1 glass

Dinner

Tomato juice with yeast
Cottage cheese
Mashed potato
Strained vegetables—strained spinach, strained green peas
Strained fruit — puréed apricots
Bread with butter — 1 slice
Milk — 1 glass

Midafternoon

Chocolate eggnog with added yeast
Sandwich with peanut butter-yeast spread

Evening nourishment

Chocolate milk with yeast

ARIBOFLAVINOSIS

During the course of an investigation of the pellagra problem in the Southern states, Dr. Sebrell and his associates discovered another disease which was due to a deficiency of riboflavin. To this disease they gave the name "ariboflavinosis." This disturbance is believed to be one of the most common of the deficiency diseases. It is rarely recognized alone, but is likely to accompany other deficiencies especially of the B complex.

In testing for pellagra, these scientists instituted a study with a group of women whom they placed upon a diet extremely low in riboflavin.[7] This modification of the classic Goldberger Tanner diet failed to produce typical pellagra, but in the course of 94 to 130 days did lead to the development of definite symptoms. Some of the women were treated with nicotinic acid without apparent improvement, but the condition cleared up when they were given small daily doses of crystalline riboflavin. This proved that the disease was not pellagra but a disease resulting from a deficiency of riboflavin.

Pathological Conditions. The symptoms observed in the experiment occurred as "cracks in the skin at the corners of the mouth (cheilosis), a greasy eruption of the skin, changes in the tongue and keratitis caused by an invasion of the cornea by blood vessels."[4] The lips and tongue became purplish red and shiny, and the fissures

Courtesy of Parke, Davis & Company

FIG. 24. SEBORRHEIC DERMATITIS INVOLVING THE FOREHEAD, EARS, POSTAURICULAR AREA, AND NASOLABIAL GROOVE, IS A COMMON ACCOMPANIMENT OF ARIBOFLAVINOSIS.

Courtesy of Parke, Davis & Company

FIG. 25. PATIENT EXHIBITS GLOSSITIS, CHEILOSIS, "SHARK-SKIN," AND CIRCUMCORNEAL INJECTION—EVIDENCES OF DEFICIENCY OF NICOTINIC ACID AND RIBOFLAVIN.

extended into the face instead of into the mouth. The eyes were found to be sensitive to light and easily fatigued. There was also itching, burning, watering, and soreness of the eyes.

Treatment. All vitamin deficiency diseases are treated with the high vitamin diet and the already mentioned vitamin formula. In ariboflavinosis the same procedure is used, adding 5 mg. riboflavin b.i.d. to the diet and formula.

SCURVY

Scurvy is a metabolic disease resulting from a deficiency in vitamin C. This disturbance was one of the first recognized of the deficiency diseases. Sailors and soldiers, explorers, and those obliged to live in far places where it was impossible to obtain fresh foods suffered from its devastating effects. Scurvy, today, occurs more frequently in infants and young children than in adults, but vitamin C deficiency, as evidenced by low blood vitamin C levels, may occur without evidences of scurvy, and is world wide in its distribution. A marked deficiency of vitamin C with the accompanying evidences of chronic fatigue and increased incidence of infectious diseases will lead eventually to the development of scurvy.

Pathological Conditions. The disease scurvy is characterized by certain pathological conditions involving tissue metabolism:[8]

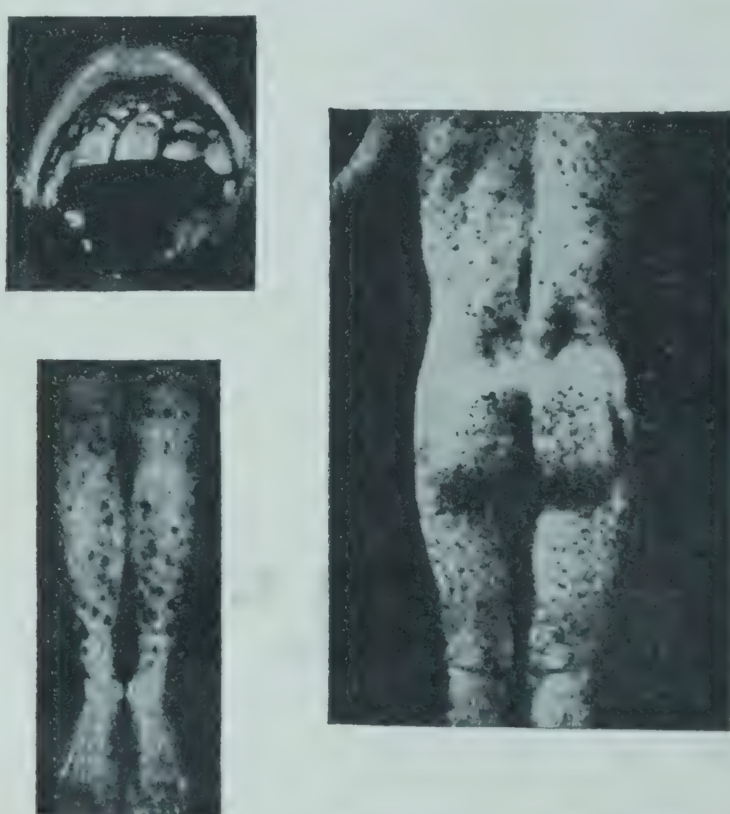
1. Structural changes in the gums and teeth (see Fig. 26)
2. Changes in the growing ends of the bones causing, at times, confusion between scurvy and rickets
3. Impairment in calcification processes resulting from improper development or degeneration of the bone matrix
4. Displacement of the bones due to the weakness of the supporting cartilage
5. Impairment of, or interference with, the functioning of the blood-forming cells in the bone marrow, as well as hemorrhages causing development of anemia
6. Damage of the heart muscles with possible enlargement of the heart
7. Hemorrhages occurring throughout the body (see Fig. 26); at times these tiny hemorrhages may be seen through the skin; they may also occur in the areas at the base of the teeth, and in the

joints, causing them to be stiff and sore; hemorrhages occur frequently in the walls of the gastro-intestinal tract

8. Muscle degeneration in general
9. Damage to the sex organs

Certain pathological conditions causing an interference with the absorption of vitamin C may lead to the development of scurvy. For example, a deficiency of hydrochloric acid may interfere with the absorption of both ascorbic acid and thiamine. There are a number of tests used to determine the presence and extent of the deficiency of vitamin C.

Treatment. In the treatment of scurvy it is not sufficient to relieve the acute symptoms, but the chronic conditions which have probably existed a much longer time must be overcome and the nutritional status raised. It may require months of treatment be-



Courtesy of Dr. L. J. Harris, "Vitamins," The Cambridge University Press

FIG. 26. THE CONSEQUENCES OF A DIET LACKING IN FRESH FRUIT AND VEGETABLES

A typical case of adult scurvy, showing the numerous petechiae—spots where blood has effused to the skin.

fore the individual has regained normal strength and vigor. The high-vitamin diet and the "Vitamin Formula" supplemented with 100 mg. of ascorbic acid t.i.d is indicated.

VITAMIN D DEFICIENCY

Nutritional diseases due to a deficiency of vitamin D and calcium may be divided into three categories; namely, rickets, osteomalacia, and tetany.

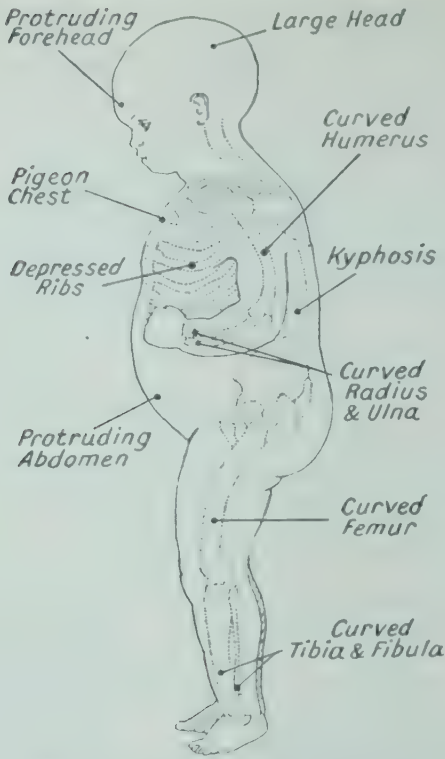
RICKETS

Rickets is a nutritional and metabolic disease of infancy and young childhood in which mineral metabolism is disturbed to such an extent that calcification of the growing bones does not take place normally. The disease occurs throughout the world but is probably more prevalent in northern regions than in the tropics. Rickets is also more likely to develop in dark overcrowded sections of large cities where poverty and ignorance make it impossible to obtain either enough food or sunshine to protect the body. Rickets is seldom fatal, but the effects upon the body of the child are devastating. If the disturbance is allowed to continue over an extended period, and the bones become deformed, neither diet or vitamin concentrates will be able to overcome these effects.

Rickets is caused by a marked deficiency in the fat-soluble vitamin D, or by a diet which is low in calcium or phosphorus, or both. Such deficiency in the diet not only produces rickets, but is also responsible for poor skeletal growth in older children, and osteomalacia in adults.

Pathological Conditions. The characteristic symptoms of rickets are:

1. Soft fragile bones
2. Enlargement of the joints
3. Deformities of the long bones of the legs (bow legs), in the chest; and in the pelvis
4. Muscular weakness
5. Restlessness and nervous irritability
6. High blood phosphatase value.



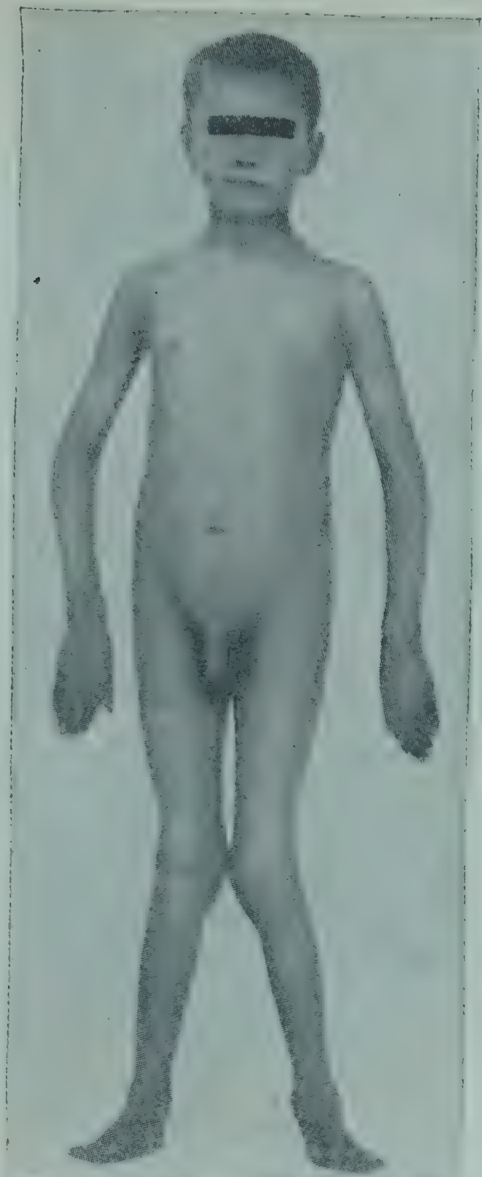
Courtesy of Dr. L. J. Harris, "Vitamins," The Cambridge University Press

FIG. 27. THE SYMPTOMS OF RICKETS

Treatment. Rachitic children require an abundance of sunshine or its equivalent in ultra violet rays, as well as increased doses of cod liver oil or other fish-liver oils. The diet itself will not contain adequate supplies of vitamin D but it should be rich in calcium. The "Vitamin Formula" with the following daily supplements of vitamin D in the form of fish-liver oils or irradiated ergosterol is recommended;[1]

1600 I.U. vitamin D for mild cases of rickets
5000 I.U. vitamin D for advanced cases of rickets
50,000 I.U. vitamin D for refractory rickets

While the normal daily allowance for vitamin D is 800 I.U. for young children, it must be remembered that premature infants may need as much as 3000 I.U. daily.



Courtesy of Dr. L. J. Harris, "Vitamins,"
The Cambridge University Press

FIG. 28. JUVENILE RICKETS

A case in a boy aged 15; note the knock-knees and thickened epiphyses at wrists and ankles.

OSTEOMALACIA

Osteomalacia, frequently referred to as "adult rickets," represents a failure of the process of calcification to keep up with the rest of the metabolic processes. Pregnant women seem to be especially susceptible to this disorder. While it does not occur to any great extent

Courtesy of Dr. L. J. Harris, "Vitamins," The Cambridge University Press

FIG. 29. "OSTEOMALACIA": RICKETS IN ADULT ("MARMALADE LEGS")

in the United States, occasional cases do appear, and it would seem to be wise to discuss it here. A condition known as "Hunger Osteomalacia" or "War Osteopathy" appeared in Central Europe after World War I, attacking adolescent boys and women between the ages of 40 and 60 years.

Osteomalacia is caused by a marked deficiency of vitamin D especially, or by interference with the calcium utilization of the body.

Pathological Conditions. The following symptoms occur in osteomalacia:

1. A softening of the bones, which may be so severe that the bones of the legs, spine, thorax, and pelvis bend into deformities
2. Pain of a rheumatic type
3. General weakness.

In hunger osteomalacia the pain occurred in the back, groins, and legs. Individuals suffering from this disturbance found it difficult to climb stairs, and developed a characteristic gait. The bones became tender and deformities of the spine and extremities frequently occurred. Multiple fractures and functional disturbances were not uncommon.

Treatment. Since general malnutrition is no doubt present it is advisable to use the high vitamin diet and the "Vitamin Formula." It is further advisable to include 10,000 I.U. of vitamin D daily as fish liver oil or as irradiated ergosterol. Foods rich in calcium must be included. The diets outlined for the pregnant and the lactating woman are excellent prophylactic measures (Chapter XIV).

TETANY

"Tetany is a syndrome manifested by a sharp flexion of the wrists and ankle joints, muscle twitchings, cramps, and convulsions. It is due to abnormal calcium phosphorus metabolism."[4] Tetany is frequently associated with rickets and osteomalacia, and, like these diseases, may be the result of vitamin D deficiency. The treatment outlined above for rickets and osteomalacia is suitable for tetany, when the primary causative factor is a lack of vitamin D.

SIMPLE GOITER

Simple goiter is due to a deficiency in iodine. Since it is associated with glandular diseases, it is discussed in detail in the latter chapter (Chapter XXIX).

SPRUE

Sprue, formerly believed to be strictly of tropical origin, is found to develop occasionally in individuals who have neither lived or visited in the tropics. According to McLester[9] sprue can no longer be considered primarily an infection, but is rather a nutritional disturbance. Individuals suffering from some intestinal disorder, such

as that induced by chronic alcoholism or chronic infections, are more likely to develop sprue than persons free from such conditions.

Pathological Conditions. Sprue is frequently mistaken for pernicious anemia since many of the symptoms are the same. However, pernicious anemia may be ruled out when free hydrochloric acid is found in the gastric juice. The usual symptoms of sprue are:

1. Gastro-intestinal disturbances, probably develop first
2. Sore tongue, glossitis
3. Diarrhea, in which the stools are grey in color, foul, and frothy
4. Distention of the abdomen with occasional cramps
5. Anemia which resembles the macrocytic anemia of pernicious anemia, although secondary anemia likewise develops in some cases
6. Nausea, vomiting, and loss of weight to the point of emaciation are common symptoms, probably caused by the inability of the patient to absorb sufficient nourishment to maintain normal nutrition.

Treatment. Many diets have been proposed for the treatment of sprue. A bland, non-irritating diet which is fully adequate in all essential nutrients together with supplementary liver extract is advisable. The protein should be of excellent biological quality. The diets outlined for the correction of anemia (page 452) are suitable. When there is a marked intolerance to carbohydrates, the sugars of the well ripened banana may be well utilized.

NUTRITIONAL EDEMA

Among the pathological conditions which have been traced to some dietary deficiency is nutritional edema. This disease is an invariable accompaniment of famine and war. Starvation over an extended period causes the tissues to become waterlogged because the levels of plasma proteins, the albumin fraction especially, are so lowered that normal osmotic pressure relationships no longer exist. In mild cases the edema is present primarily in the legs, but it is likely to extend throughout the entire body as the condition becomes more severe.

Pathological Symptoms. Nutritional edema does not become

manifest until the body reserves of protein have been used up and the blood proteins are sufficiently lowered. A diet may consequently be deficient for several months, or even longer, before recognizable protein deficiency occurs. The symptoms of chronic deficiency include: (1) edema; (2) loss of weight and emaciation; (3) anemia; (4) muscular weakness, fatigue, and depression; (5) low pulse rate and low blood pressure; and (6) possible gastro-intestinal disturbances.

Treatment. The treatment requires replacement of the proteins of the plasma and of the hemoglobin, as well as of the tissues. Depending upon the length of time the deficiency has been present, correction of the condition may require weeks or months. Much more protein may be required for tissues than for the blood itself. Under normal conditions the adult allowance for protein is 60 to 70 Gm. daily, but for correction of deficiency it is advisable to ingest 100 Gm. or more of protein daily (see high protein diet, page 438). Even more important is the quality of the protein. A large proportion of that eaten should come from the superior protein foods — eggs, milk, cheese, meat, fish, poultry, and soybeans. In addition to adequate protein therapy it is necessary to stress the importance of a liberal caloric intake since protein will be used for fuel if the diet does not supply enough calories. Vitamin deficiencies are common when edema occurs; therefore, it is advisable to use a high-vitamin diet as well.

Casein hydrolysates (Amigen, for example) are being used with notable success in the correction of protein deficiencies. These products are not very pleasing to the palate, but a 10 per cent solution may be given with equal amounts of tomato juice. If 100 cc. of this mixture are taken hourly between meals, effective supplementation of the high protein diet is brought about.

SUMMARY

Beriberi and scurvy were disturbances recognized as results of some lack in the diet long before the specific factors which caused them were recognized, but these diseases are only two in the list of disorders due to malnutrition. Research has brought to light others which are equally devastating and which must be recognized and treated as quickly as possible.

Deficiency diseases are much more prevalent today than formerly believed. Prolonged malnutrition no matter what the cause inevitably leads to the deprivation of the body of some vitally needed substance. This deprivation, whether it be protein, vitamins, or calories, results finally in the development of what is now called a deficiency disease.

Acute deficiency is likely to be recognized, but the chronic or mild forms often pass unnoticed until some specific acute symptom appears and the disease has made such headway as to deprive the individual of health, vigor, and good posture. Thus, the early recognition of deficiencies and immediate steps to overcome them is the keynote to success in the treatment of such disturbances. Prevention is better than attempted cure, and an adequate diet together with good habits of rest, sleep, fresh air, and exercise are the best means for maintaining good health.

The world war has quickened the interest and stimulated the work of fighting deficiency diseases as well as of educating the public to the necessity of using foods which supply the essential nutrients to safeguard the body against the development of such disturbances. But the work cannot stop there. It is necessary to examine the history of the individual suffering from deficiencies and the family history so that no avenue of approach may be overlooked. Diet itself is not always to blame. Something may be wrong with the body or its functions which prevents utilization of the food provided. Poor absorption, impaired motility and secretory processes, as well as disturbed metabolic processes must be ruled out before placing the entire onus upon the food intake. This is the business of the physician today, and day by day the public is benefiting by his scientific knowledge. The diseases and their characteristics as well as the treatment are summarized in the outline on pages 295-6.

In the treatment of deficiency diseases education is an outstanding factor. Individuals must be taught to select the proper foods to make up an adequate diet, how to prepare the foods to safeguard the vitamins and minerals, and how to substitute good food habits for bad ones. Early recognition of the symptoms of malnutrition will help to prevent occurrence of the more severe deficiency diseases.

SUMMARY OF DEFICIENCY DISEASES

DISEASE	CAUSE	PATHOLOGY AND METABOLISM	CHARACTERISTICS OF THE DIET
Xerophthalmia and Night blindness	Marked deficiency of vitamin A in the body; probably other vitamin deficiencies, less marked	Swollen, congested eye and eyelids; impairment of the lacrymal glands which supply secretion which normally washes away bacteria; retarded regeneration of visual purple, making it difficult to see in dim light	Rich in vitamins and adequate in all nutrients — the high-vitamin diet; supplementary vitamin A
Beriberi a) Dry type b) Wet type	Deficiency in vitamin B_1 (thiamine) resulting from inadequate diet; chronic alcoholism; impairment of function of digestion, absorption, utilization; possibly an excessively high carbohydrate intake	Impairment of neuromuscular and cardiomuscular systems; muscle weakness; paralysis of limbs; gastro-intestinal disturbances; emaciation in the dry type and edema in the wet type	High-vitamin diet or high-vitamin high-calorie diet; vitamin formula plus 10 mg. thiamine daily
Ariboflavinosis	Deficiency of riboflavin or vitamin B_2	Cheilosis or lesions at the angles of the mouth causing fissures extending into the face; lips abnormally red and shiny; changes in the tongue; greasy eruption of the skin; lack of vigor	High-vitamin diet plus vitamin formula and 5 mg. riboflavin b.i.d.
Scurvy	Deficiency of ascorbic acid (vitamin C) due to dietary lack or inadequate utilization as in achlorhydria	Structural changes in teeth and in the growing ends of the bones; tender painful joints; interference with the function of cells in the bone marrow; damaged heart muscles; hemorrhages throughout the body	High-vitamin diet plus vitamin formula and 100 mg. ascorbic acid t.i.d.

SUMMARY OF DEFICIENCY DISEASES (*Continued*)

DISEASE	CAUSE	PATHOLOGY AND METABOLISM	CHARACTERISTICS OF THE DIET
Rickets Osteomalacia or Adult Rickets Tetany	Deficiency of vitamin D or impairment of calcium metabolism	Soft fragile bones; enlarged joints; deformities in the long bones of the legs, chest, and pelvis; muscular weakness. In adult rickets the bones become abnormally tender and bend in the legs, spine, thorax, pelvis; multiple fractures occur; pain of rheumatic character	Vitamin D concentrates: 1600 I.U. daily for mild rickets; 5000 I.U. daily for advanced rickets; 10,000 I.U. daily for adult rickets
Sprue	Unknown etiology; prolonged malnutrition and infections are predisposing factors	Sore tongue; glossitis; gastro-intestinal disturbances as diarrhea, cramps, nausea, vomiting; abdominal distention; anemia similar in type to pernicious anemia; presence of gastric hydrochloric acid rules out pernicious anemia	Soft diet with liberal protein and liver therapy; bananas a good form of carbohydrate
Nutritional Edema	Protein deficiency, especially proteins of good quality	Edema, first of the lower limbs, then of the entire body; loss of weight; anemia; muscular weakness; low level of serum proteins; low pulse rate and low blood pressure	High-protein diet with emphasis on eggs, milk, meat, fish, poultry, soy beans; Casein hydrolysates by mouth or by vein

PROJECTS

1. Prepare an outline which lists the recognized deficiency diseases, their causes, symptoms, and effective treatment.

2. Calculate the vitamin content of the High-Vitamin Diet, pages 272–4.

3. Plan a high-calorie, high-vitamin, high-protein diet for a man 40 years old, 5 ft. 10 inches tall, who shows symptoms of dry beriberi.

4. Arrange a diet suitable for a nine months old infant with scurvy; with rickets. Refer to Chapter XVI on Infant Feeding.

5. Calculate the protein, calories, thiamine, riboflavin, and niacin in the soft diet used for treating pellagra (page 283).

REVIEW QUESTIONS

1. What constitutes a deficiency disease?
2. Name the chief causes for deficiency diseases.
3. Why is the high-vitamin diet usually supplemented with vitamin concentrates for the treatment of deficiency diseases?
4. List the constituents of the vitamin formula.
5. What is meant by each of the following: ariboflavinosis, cheilosis, pellagra, nutritional edema, sprue, night blindness?
6. Name the deficiency diseases in which anemia is a specific symptom.
7. What factors are important in reducing the incidence of deficiency diseases?

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CHAPTER XXI

Diet in Obesity and Underweight

OBESITY

Obesity is an abnormal condition manifested by an excessive accumulation of fat in the body. The desire for an attractive figure yearly leads thousands of women to beauty salons for various reduction regimens. The true importance of the problem, however, lies in its relation to health although the demands of beauty will also be met if objectives of health can be realized. Obesity is a serious handicap in several respects. Physical activity is markedly limited by overweight, and muscles cushioned with fat are not able to contract readily. The skin suffers from a loss of free circulation when excessive layers of fat are just beneath it and the heat of the body is not properly regulated if these layers are too thick, because fat serves as an insulator. Excess fat places a great burden on the heart, and the presence of fat about that organ lessens its ability to meet the additional demands upon it. In the abdomen too much fat interferes with the free movement of the diaphragm and of the organs. Obesity, moreover, is a predisposing factor in diabetes, hypertension, gout, and gallbladder disease. It constitutes a risk for the patient who needs surgical treatment. In other words, overweight is an extremely important contributing factor in the shortening of the life span. There is a popular saying "The longer the belt, the shorter the life."

Cause of Obesity. Contrary to popular belief there is but one true cause of obesity, namely, an intake of calories beyond the body's need for energy[1]. It will be remembered that calories not needed for the work of the body and maintenance of body temperature are deposited as adipose tissue. A clear understanding of the reasons for excessive food intake is necessary if successful treatment is to be initiated. A thorough physical examination of the individual, a study of his history, and an investigation of the personal

habits — amount of food and drink, exercise, sleep, medicines if any — should be made. Once the causes for overeating are determined the treatment is fairly simple.

Investigations by several groups of workers have shown that most obese individuals have a normal basal metabolism when the rate is referred to surface area. As a matter of fact, they require more energy or calories than the normal individual to perform a given piece of work. It has been further shown that overweight people utilize food no more efficiently than those of normal weight, and that there is no essential difference in the metabolism of carbohydrate or fat.

Some persons possess abnormal appetites although their energy requirements are like those of a normal individual. Newburgh[1] cites cases in which dramatic gains in weight occurred following problems — social, sexual, or financial — for which the patients could find no solution. They therefore resorted to the solace and pleasures of eating additional foods. Other people overeat due to their choice of foods which are high in caloric value rather than those which are bulky. Many instances of so-called hereditary obesity can be explained by family food customs.

A large number of individuals become overweight because they fail to adjust their appetites to lowered energy requirements. What might have constituted a normal need at one time of life becomes an excess at another. There are several conditions in which this may occur: (1) the energy needs of middle age are less than those of youth; (2) disabling illness may reduce markedly the need for calories; (3) changes in occupation may result in reduced activity; (4) the middle years of life sometimes bring about a repose and consequent reduction of muscle tension; (5) periods of rest and sleep may be altered; and (6) endocrine disturbances as hypothyroidism may lower the basal metabolic rate to an appreciable extent so that less energy is required. If the energy intake or the habits of eating are not adjusted to these lower requirements there can be only one result — progressive increase in weight.

Indications for Weight Reduction. The height-weight tables may be used as a basis for determining the degree of overweight. These tables have been obtained by weighing many individuals and represent averages only. It has been suggested that some consideration

should be given to the individual's frame, whether he is slight, stocky, or of medium frame. A range of 5 to 10 per cent over the average may be allowed for the stocky individual and 5 to 10 per cent under the average for the individual whose frame is slight. On the basis of life insurance statistics the ideal weight at thirty years of age is the best weight to maintain for the remainder of one's life. If height-weight tables are not available the approximate ideal weight for an adult may be estimated by assuming an average weight of 100 to 110 pounds for the first five feet, and adding an additional 5 pounds for each inch over five feet.

Weight reduction should be carried out solely for the improvement of one's health, and it becomes important to consult a physician as to advisable measures which can be taken. Patients with severe cardiac disease and old people who have been obese for a long time frequently withstand the weight losses poorly and must be especially watched.

Not only does weight reduction result in a decreased tendency to diabetes, hypertension, cardiac disease, gout, and gallbladder disease, but it also improves the physical condition of the obese individual who may already be afflicted by one of these diseases.

Treatment of Obesity. Just as there is one true cause of obesity so there is but one effective treatment: reduction of energy intake below the energy requirements of the body.

Before a dietary regimen is instituted a careful explanation of the treatment must be given to the patient. A sincere desire on the part of the patient to lose weight together with sufficient will power to adhere to the diet is absolutely necessary if success is to be expected. A weight chart which is kept from week to week is most helpful. In this respect, however, it must be explained to the patient that the occasional failure to lose weight for the first two or three weeks is merely due to a temporary withholding of water by the tissues, but that invariably this water will be lost and weight losses will continue to take place if one adheres strictly to the diet. Failure to understand this point has frequently led patients to lose confidence in the treatment before the diet had been used long enough for results to be seen.

The ideal diet for weight reduction is one which contains sufficient protein, minerals, and vitamins to meet the body needs, and

which is satisfying to the palate. The needs for the nutrients are those given in the Yardstick for normal individuals (page 128). The frequently used fad diets should be thoroughly discouraged, since many of them are seriously deficient in one or more of the nutrients.

Use of Drugs. Many of the "obesity cures" so widely advertised include extracts of one or more of the ductless glands to speed up or stimulate the body's basal metabolic rate. Too much cannot be said against the indiscriminate use of such treatment. Most overweight people have no deficiency of endocrine secretions and should not be led to believe that they have glandular disturbances, nor should they be exposed to the increased nervousness and irritability which results from such medication. Thyroxin and similar preparations should be taken only under the careful supervision of a physician.

Effect of Exercise. It is true that an increase in activity will result in a loss of weight provided one's intake of food is not also increased. Unfortunately many people experience a much greater appetite following exercise which is difficult to control. If a person obtains pleasure from increased activity there is no reason to restrict him unless he has a cardiac deficiency. For most people it is extremely difficult to exercise markedly and at the same time to restrain the appetite.

Planning the Energy Intake. Since it is assumed that the diet must contain all the nutritive essentials except energy, the problem in planning becomes one of estimating the number of calories to be used. There are two schools of thought: those who advocate a mild reduction regimen[2], and those who believe drastic reductions in calories are necessary[1,3].

Moderate Reduction Regimen. A gradual loss of six to eight pounds monthly is considered most desirable by many physicians, since the patient does not experience the severe hunger and weakness which often accompanies drastic reduction regimens. To bring about such a weight loss the daily caloric intake must be reduced 30 to 50 per cent below the body's need for calories. This would necessitate an intake of 8 to 12 calories per pound of ideal body weight for a person of moderate activity. The balance of energy will be derived from adipose tissue with a resultant loss in weight.

One may also resort to an arbitrary choice of 1200, 1000, or 800 calorie diets. For example, if the 1200 calorie diet does not produce satisfactory weight loss the next lower level of calories may be selected. On the other hand too rapid a weight loss can be curtailed by increasing slightly the calories for those who are more active. A diet which contains 1000 calories less than the individual's daily energy requirement will produce a monthly loss of approximately eight pounds.

It should be emphasized that a diet containing 800 calories or less is deficient in vitamin A and the B complex. If such diets are used for more than two weeks it is important to prescribe concentrates.

Severe Reduction Regimen. Newburgh and others recommend an extremely low caloric intake — 450 to 600 calories — for the obese, since more dramatic losses in weight are apt to be most encouraging to the patient. They emphasize the importance of adequate protein intake, and of sufficient supplementation with vitamins.

Selecting Food to Fill the Diet. The patient must have a sense of satisfaction and well being after eating, which can be effected by considering the satiety value of foods. Proteins which are slow of digestion and remain in the stomach a long while should be included at each meal. Thus the inclusion of an egg at breakfast, cottage cheese or lean meat at lunch, and lean meat again at dinner is strongly urged. The satisfying bulk of green vegetables of low caloric value is well recognized, and they should constitute a large part of the diet. Unusual hunger between meals can be allayed in part by saving the fruit ordinarily allotted to the meal for between meal snacks. Fat-free broth and tea without sugar may also be used. The intake of fat foods or those high in carbohydrate should be limited since these foods are low in satiety value. Whenever disease conditions such as diabetes, gallbladder disease, cardiac deficiency, etc., are present the low-calorie diet must be so planned that it conforms to the important principles of diet therapy in the disease concerned.

The accompanying chart illustrates the amounts of food which may be used daily on three caloric levels. Such a plan offers a wide choice of foods since most fruits and vegetables fall into the classifications indicated. The tables of classification of fruits and vege-

tables in the appendix (page 721) will illustrate the choices which are possible.

SERIES OF REDUCTION DIETS

FOOD FOR THE DAY	800 CALORIES	1000 CALORIES	1200 CALORIES
Milk	1 pint (skim)	1 pint, whole	1 pint, whole
Egg	1	1	1
Lean meat, fish, poultry, or cottage cheese	2 servings (6-8 ounces)	2 servings (6-8 ounces)	2 servings (6-8 ounces)
Vegetables — 3, 6, or 9 per cent	4 servings	4 servings	4 servings
Potato	....	....	1 small
Fruit — 6, 9, or 12 per cent	3 servings	3 servings	3 servings
Bread, whole grain	1 thin slice	2 slices	2 slices
Butter	1 teaspoon	2 teaspoons	3 teaspoons

Avoid these foods (except in quantities allowed in chart):

High-fat foods: butter, cheese, chocolate, cream, ice cream, fat meat, fatty fish, or fish canned in oil, fried foods of any kind such as doughnuts and potato chips, gravies, nuts, oil, pastries, and salad dressing

High-carbohydrate foods: breads of any kind, candy, cake, cookies, corn, cereal products as macaroni, noodles, spaghetti, pancakes, waffles, sweetened or dried fruits, legumes as lima beans, navy beans, dried peas, potatoes, sweet potatoes, honey, molasses, sugar, syrup, rich puddings

Beverages: all fountain drinks including malted milks and chocolate, carbonated beverages of all kinds, rich sundaes, alcoholic drinks

LOW CALORIE DIET

(1200 Calories)

TYPE DIET	SAMPLE MENU
Breakfast	
Unsweetened fruit — 1 serving	½ Grapefruit
Egg — 1	Soft cooked egg
Toast — 1 slice	Wholewheat toast
Butter or fortified margarine — 1 teaspoon	Butter
Beverage	Coffee — no sugar

LOW CALORIE DIET *(Continued)*

TYPE DIET	SAMPLE MENU
Lunch or supper	
Lean meat, fish, poultry, or cottage cheese	Cottage cheese on
Vegetable salad — large portion 3 or 6 per cent	Lettuce and tomato with lemon or vinegar
Bread — 1 slice	Whole-grain bread
Butter or fortified margarine — 1 teaspoon	Fortified margarine
Milk, whole — 1 glass	Milk
Unsweetened fruit — 1 serving	Grapes
Dinner	
Lean meat, fish, or poultry — 3 to 4 ounces	Roast beef
Potato — 1 small serving	Mashed potato with
Butter — 1 teaspoon	Butter
Vegetable, 6 or 9 per cent — 2 servings	Spinach Carrots
Milk, whole — 1 glass	Milk
Unsweetened fruit — 1 serving	Fresh strawberries

Obesity in Childhood. Children, like adults, become overweight because they eat in excess of their daily requirements. The first step toward the correction of the obesity is a determination of the reason for overeating.[4] Many children are fat because their mothers have assumed an over protective attitude and have fed their children large quantities of food in the mistaken notion that it was necessary. For example, a child may have been ill at one time and eating poorly; the extra amounts of high caloric foods which were fed during convalescence may not have been reduced so that the child continued to gain weight. Then again, large amounts of concentrated foods, as candy, have frequently been used by the mother as a bribe. The mother thus retains an intimate hold on her child who craves more and more sweets. The fat child is often an unhappy child who may be eating simply for the solace which he obtains from food.

It is usually not wise to employ as marked dietary restriction for children as for adults. All of the essentials for good nutrition must

be included so that tissue and stature development are not affected while weight is being lost. The calories are usually limited to 1200-1800 daily. The diet for adults on page 303 may be used as a basis for planning the diet for the child. To this diet should be added 1 to 2 cups of milk daily so that the child receives a total of 3 to 4 cups of milk in his diet.

A determination of the cause of overeating and the planning of the proper diet are both essential if successful weight reduction is to be effected in children. Of equal importance is the continued interest in the child as shown by a careful follow-up of the progress which is being made. It is vital that the child (and his mother) be so approached that he will realize what a loss of weight may mean to him. For some children this means emphasis on good appearance, poise, and gracefulness; for others it means greater participation in sports; and for still others it implies the approbation of fellow playmates and schoolmates.

UNDERWEIGHT

Weight is an index to health, and any persistent loss of it in an adult or even a failure to gain in a growing child is an indication that all is not well, and immediate measures must be taken to locate and relieve the trouble. Wasting diseases such as tuberculosis and anemia bring about loss of weight, as do fevers in general. In typhoid fever the tissues are broken down not only because of the increased metabolism caused by the febrile condition but also because of the action of bacteria. Loss of sleep, unsanitary surroundings, and capriciousness of appetite sometimes cause excessive thinness. Certain individuals are said to be "constitutionally thin"; this is partly a question of inheritance of body build and partly a question of family food habits and temperament. Malformation or deformity of the mouth, throat, or stomach, which makes it impossible for the individual to partake of sufficient food to cover his nutritional needs, may be the cause of emaciation.

Modifications of the Diet. The purpose of dietary management is directed toward increasing the weight. In cases brought about by disease, the loss of weight can be overcome only by removing the cause, after which the diet must be adjusted to meet the existing condition. Bad health habits — such as overwork, sleeping in un-

ventilated quarters, lack of sleep and of outdoor exercise, plus poor personal hygiene and food habits — are influencing factors in loss of appetite and consequent loss of weight. These factors must be corrected before an adjustment of diet can be made efficacious.

The diet for the individual who needs to gain weight is a normal diet with sufficiently increased caloric intake that weight gain may be effected. These factors require special consideration:

Energy. Calories should be sufficient for the daily total metabolism and should in addition allow for a gain in weight. The daily total will vary widely depending upon the cause of the underweight. Approximately 500 calories in excess of the needs for total metabolism should be included daily. The weight gain is the best index to the desired caloric level.

Protein. Many individuals who are underweight have experienced some loss of body protein tissues as well as body fat, and consequently a liberal allowance of protein is indicated.

Vitamins. It goes without saying that the diet should be adequate in vitamins. Certain factors as the B complex may be of great value in stimulating a jaded appetite. Others may have been lacking in the diet of the individual so that various deficiency states have become manifest.

Minerals. All of the minerals should be provided in normal amounts. Iron frequently needs to be stressed, as does also calcium.

Planning the Daily Diet. The meals must be carefully selected, well prepared, and daintily served, because the patient must eat regardless of lack of appetite, if weight is to be increased. Food must be simple in order not to overtax the digestion by the quantity ingested. The patient cannot immediately adjust from a low-caloric level to one which is considerably higher. It is better to progress the diet by stages, allowing each day a little more food than on the previous day. Nothing is more conducive to loss of appetite than the appearance of an overloaded tray of food.

Intermediate feedings of high caloric beverages may be given if they do not interfere with the appetite at meal times. A somewhat larger feeding of easily digested food may be included before retiring. It is desirable to strive to include these foods daily:

3 cups milk
1 cup light cream

2 eggs
1 large serving meat, fish, or poultry
2 ounces (or more) butter or enriched margarine
1 potato
2 to 3 servings fruit — one should be orange, grapefruit, or tomato
2 to 3 servings vegetables in addition to the potato — green and leafy; one to be raw
3 to 6 slices whole-grain or enriched bread
1 serving whole-grain or enriched cereal
High caloric foods to complete the caloric requirement: cereals as macaroni, rice, noodles, spaghetti; honey, molasses, syrups; hard candies; glucose or cerelose; salad dressings; cakes, cookies, and pastry in moderation; ice cream, puddings, sauces

The type diet must be adjusted to the individual abilities of the patient. The pattern outlined for various deficiency diseases (page 274) is suggestive of the arrangement of foods for underweight.

SUMMARY

Obesity is a handicap to ordinary physical activity, to the circulatory system, to the regulation of body temperature. It is a predisposing factor in diabetes, gallbladder disease, cardiac disturbances, hypertension, and gout.

The true cause of obesity is the consumption of foods in excess of the body's need for energy.

Overeating may occur in two general groups of persons:

1. Those who have normal energy requirements but in whom abnormal appetites have been established because of childhood habits, or the solace which eating may bring to every day problems.

2. Those who have normal appetites but lowered energy requirements because of less active occupations, increased periods of rest and relaxation, reduction of muscle tension, and occasionally endocrine disturbances.

The most satisfactory treatment for obesity is the daily adherence to a low-calorie diet which contains all the essential protein, minerals, and vitamins.

Mild reduction regimens (1000 to 1200 calories) are usually preferred since it is easier to include all the nutritive essentials and the patient is less apt to experience severe hunger and weakness.

Foods should be selected so that maximum satiety value is obtained. Protein foods and bulky fruits and vegetables are ideal for this purpose.

The correction of obesity in children is accomplished only if the causes of overeating are determined, the diet is planned carefully for weight loss without a sacrifice of good nutrition, and the child is properly approached so that he has an interest in losing weight.

Just as the obese person eats too much, so the underweight individual eats too little. For the latter individual it is necessary to increase the food intake to a point where the calories exceed the needs of total metabolism by 500 calories or more daily. The underweight person often needs extra protein, minerals, and vitamins as well as calories if weight gain is to be effected.

The diet for underweight persons should be planned to stimulate the appetite. Appearance of the food, size of portions, attractive service, and palatability are factors of especial importance. Small feedings five or six times a day are preferable to three meal regimens.

PROJECTS

1. Plan a low-calorie diet for a woman who is 5 feet 2 inches tall and who weighs 165 pounds. Calculate the caloric value of one day's menu by consulting food tables.

2. Calculate the number of grams of each of the following foods necessary to supply 100 calories: bread, milk, butter, tomatoes, potatoes, baked ham, lean beef, apples, oranges, and ice cream.

3. Plan an adequate 1400 calorie diet for a child 11 years of age. Calculate the vitamin A, thiamine, ascorbic acid, and iron values of this diet.

REVIEW QUESTIONS

1. Give 4 reasons why obesity is a serious handicap to health?

2. Eating food in excess of the body's need for energy is the cause of obesity. List 8 situations in which overeating may occur.

3. How does the basal metabolism of an obese individual compare with that of a person of normal weight?

4. When is weight loss indicated? Contraindicated?

5. How could you determine the approximate ideal weight for an individual if no height weight tables were available?

6. List the nutritive essentials which must be included for a low-calorie diet.

7. What are the principles of a moderate reduction regimen? What weight loss can be expected on such a regimen?

8. What deficiencies may occur when a diet contains 800 calories or less? How may these deficiencies be avoided?

9. What alterations may occur in water balance when low-calorie diets are first used?

10. What objections are there to the use of drugs for weight loss?

11. Is exercise effective in bringing about weight loss?

12. What is meant by the satiety value of a food?

13. List foods which should be emphasized for use on low-calorie diets.

14. What foods are generally avoided on low-calorie diets? List ten of them.

15. List several factors of importance in correcting obesity in children?

16. What are some of the factors which may contribute to loss of weight?

17. What foods would you emphasize in the diet of a person who needs to gain weight?

18. In addition to the emphasis on certain foods for underweight persons, what other plans would you make to bring about successful treatment?

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CHAPTER XXII

Diet in Surgical Conditions

The dietary regimen which is employed for preoperative and postoperative cases is frequently regarded as a simple routine for which there are certain rules to observe. Recent years have brought gradual but decided improvements in the feeding of surgical patients. Surgeons are becoming more and more aware of the relationship which may exist between specific nutritional disturbances and serious postoperative complications. Dr. Stewart says: "One of the most important considerations in making the difficult and complicated present-day surgical operations safe, is proper care of the patient's nutrition before and after operation. The most carefully planned and brilliantly executed operation may end in disaster if performed on a patient suffering from grave nutritional disturbances." [1] There are evidences to show the close relationship between specific nutritional disturbances and serious postoperative complications.

PREOPERATIVE DIETS

Dietary Modifications. Whenever an operation is not of an emergency nature it is important to improve the state of nutrition. A fairly simple operation may involve a moderate to a marked deficiency in food intake for three to eight days following operation. The only source of nutrients then is the body itself. To avoid excessive loss of body materials it is vitally important that reserves be built up as much as possible. It is undoubtedly true that an individual has a better chance for a complete recovery after operation if his nutritional status is good. This usually entails an emphasis on certain food constituents.

Protein. It is only in recent years that the significance of proteins in wound healing has been recognized. It is well known that a patient who has not been eating properly for some time will have

suffered depletion of tissue proteins as well as a lowering of the serum proteins. This condition in turn aggravates an edema which may be particularly adverse in its effect on the healing of the wound. In operations on the stomach the presence of edema may also act as a mechanical hindrance to the forward movement of the gastric contents. A second equally important reason for emphasizing an adequate (and in some cases high) intake of protein is the protective action which proteins exert on the liver, thus avoiding the toxic effects of anesthesia and minimizing the dangers of postoperative shock. Thirdly, protein is an essential nutrient for the repair and regeneration of tissue at the site of the wound.

Carbohydrate. The storage of glycogen in the liver has a highly protective effect on hepatic tissue in that proteins are spared, and damage to the liver is avoided. The dangers of a low blood sugar and postoperative acidosis and shock are thus counteracted. To effect a reserve of glycogen it is necessary to insist upon a liberal intake of carbohydrate preferably for several days before operation. As much as 800 Gm. of carbohydrate are readily given daily by means of lemonade sweetened with glucose (refer to recipes for beverages, page 590). Since the sugar is already in its simplest form, one can force this beverage until midnight just preceding the operation, or even until the next morning if the operation is scheduled for the late afternoon.

Energy. Obviously, the energy intake must provide a surplus of calories if the patient is to store protein and glycogen. The frequent incidence of weight loss necessitates a high-calorie diet preceding operation.

Vitamins. A liberal allowance of all of the vitamins is necessary for the restoration of good nutrition. Stewart has this to say about the importance of vitamins: "Rupture of abdominal wounds may follow operation in the presence of serious vitamin C deficiency; fatal bleeding from the wound may occur as a result of failure in intake or utilization of vitamin K; gastro-intestinal atony and distention may be due to lack of the elements of the vitamin B complex; edema of the brain, convulsions and mania may occur after operation on a patient suffering from chronic thiamine (B_1) deficiency".[1] It is now a common practice to prescribe vitamin concentrates for a week before operation.

Fluids. A patient should not go to operation in a state of dehydration, since the subsequent dangers of acidosis are great.

Consistency. The consistency of the food before operation will be governed by the condition of the patient and by the type of operation which is to be performed. If the gastro-intestinal tract is involved it may be advisable to use a diet low in residue for two to three days prior to operation.

Time for Feeding. The old practice of starving the patient for 24 hours was harmful in that a low blood sugar and acidosis were frequent complications. The object of withholding food is to insure an empty stomach so that nausea, vomiting, and distention are less likely to occur. However, this requires merely that no food be given after midnight just preceding the operation. Whenever the operation is planned for the late afternoon the patient may usually be permitted to have a light breakfast such as toast and coffee.

Planning the Preoperative Diet for the Type of Operation. The nature of certain operations requires specific dietary consideration. In toxic goiter it is essential to accomplish an actual gain in weight before operation. The high rate of metabolism makes an intake of 4000 to 5000 calories imperative. A complete discussion of diet in these conditions is given in Chapter XXIX.

POSTOPERATIVE DIETS

Dietary Modifications. The principles set forth for preoperative dietary regimens are not modified following operation. The main alteration will be in the consistency and the type of food used.

Fluid. The first effort subsequent to operation is to maintain the fluid balance. A review of Chapter IX on water metabolism will bring to the attention of the student the large amounts of fluid intake and output daily in the normal individual. For a period of time following the operation, however, the patient will obtain little fluid except as such, since foods will be consumed in limited quantities. On the other hand, the excretion may be increased for several reasons: (1) the kidney may be required to excrete greater quantities of waste products and hence require greater amounts of water to dissolve these wastes; (2) vomiting may account for large losses of fluid; (3) an elevated temperature results in the dissipation of

increased quantities of water; and (4) wound drainage and hemorrhage may be responsible for additional losses. If the water requirement cannot be met by oral administration it becomes necessary to resort to the use of parenteral fluids. The need for salt parallels the need for fluid.

Progression of Diets. The type of diet used and the rapidity of progression will depend upon the kind of operation. The amputation of a leg with spinal anesthesia does not require the same degree of food restriction as a gastric resection. Nausea, vomiting, and abdominal distention are frequent problems. Golden and Martin believe that "lack of food in the gastro-intestinal tract is conducive to the production of gas and subsequent distention."[2] This in turn results in interference with digestion and absorption. They state that the ability of the patient to take food depends on whether or not absorption is taking place from the intestinal tract and whether the kidneys are functioning. It is possible to determine this by simple tests. These men have found that early feeding of the patient leads to a marked reduction in wound infections, postoperative nausea, and vomiting. In uncomplicated cases the patient's appetite is a good guide as a rule. The ultimate objective is a return to normal dietary habits as soon as possible. The general order in which the diets are given is:

Clear fluids; may be supplemented with protein
Full fluids
Soft diet
Regular diet

These routine diets have been described in some detail in Chapter XIX.

Diet Following Gastro-intestinal Operations. When an incision has been made in the stomach wall it is of prime importance to avoid nausea. The only feedings usually permitted are tea and thin water gruel sweetened with glucose. Small amounts — 30 to 60 cc. — may be given hourly with gradual increases on the second and third day. If the patient's condition warrants, the Sippy Regimen (Chapter XXIV) may be begun on the fourth postoperative day. The feedings must continue to be small (about 6 ounces per feeding), frequently given, bland, and easily digested. At the

end of two weeks the patient is usually able to tolerate a bland diet in small meals. It may be necessary to restrict the foods to those of a soft nature for several months.

Operations on the intestines and rectum require the use of a very low residue diet subsequent to operation in order to avoid bowel movement for four to five days. Such a diet allows eggs, minced meat, white bread and cereals, potatoes, starchy foods as rice, noodles, spaghetti, plain puddings, custard, junket, plain gelatin desserts and ice cream. All fruits and vegetables are contraindicated. This diet is described in detail in Chapter XXVI.

An operation on the esophagus may require the insertion of a tube directly into the stomach. Because the tube feeding is often the only means of nourishment for weeks or even months it is essential that all of the nutrients be included daily. The following formula if entirely used in a 24-hour period will provide ample amounts of all of the nutrients for the sedentary adult. Supplementary fluid foods may also be given.

GASTROSTOMY TUBE FEEDING[3]

6 cups milk
½ cup sugar
⅔ cup fine cereal, as farina
1 cup tomato juice
½ cup molasses
3 eggs
½ teaspoon salt

Method of Preparation. Scald the milk in the top of a double boiler. Beat the eggs slightly and add the milk slowly, stirring all the time. Add the sugar and cook in the top of the double boiler stirring constantly until the mixture thickens slightly to form a thin coating on the spoon. Cool the mixture thoroughly. Add the farina, tomato juice, molasses, and salt. Stir well after the addition of each ingredient. Strain the mixture through a medium fine sieve, cover well, and place in refrigerator. Tube feedings should always be given at body temperature.

If a tube is inserted into the jejunum the eggs and milk in the above recipe should be peptonized for three hours. The cereal is omitted in the jejunostomy tube feeding.

Postoperative Diets in Gallbladder or Liver Disease. The usual progression of diets is followed for operations which involve the gallbladder or biliary ducts except that the fat content must be kept low. Protein, glycogen, and vitamin deficiencies are frequently

present in liver diseases because of inability to synthesize proteins and utilize vitamins. In some cases vitamin concentrates together with bile salts to aid in absorption may be prescribed by the surgeon. A high-carbohydrate, high-protein, low-fat diet is recommended in these conditions (see page 377).

Diet Following Appendectomy. In uncomplicated cases a patient who has had the appendix removed is able to take a full fluid diet on the day following operation, with rapid progression to a regular diet by the end of the third or fourth day. On the other hand, it is important to observe great caution in the feeding of those patients in whom peritonitis is present. Usually the patient is given only small amounts of water by mouth, supplemented with injections of glucose in large quantities.

Diet Following Operation on the Thyroid. The liberal use of glucose before, during, and after operation on the thyroid is perhaps of greater importance than in any other disease condition. A high-calorie diet should be used as soon as possible to compensate for the high metabolic rate.

Diet Following Tonsillectomy. The patient may be given any food which he can swallow. Tart fruit juices and fruits, and fibrous foods may be undesirable while the throat is still quite sore. Ice cream is usually one of the first foods allowed.

SUMMARY

The state of nutrition is of prime importance for the patient who is to have an operation. A glycogen reserve is essential if low blood sugar, acidosis, and liver damage are to be avoided. Optimum protein nutrition is a further safeguard against hepatic injury, and a protection against the ill effects of nutritional edema. To these ends the patient should be given a diet high in protein (100 Gm. or more daily), and high in carbohydrate (500 Gm. or more daily) prior to operation. Liberal intakes of vitamins are urged for those patients who present any deficiency.

Postoperative dietary care requires first of all the prompt replacement of fluids and salt with as rapid a progression of diets as is compatible with the disease condition which is present. The limited fluid diets are nutritionally inadequate and should be used for

a short time only. Whenever they must be used for longer periods it is necessary to use transfusions or parenteral means of supplying nourishment.

Many patients find that solid foods are less nauseating and distending than fluid foods. The consistency and choice of food will be determined by the nature of the operation.

PROJECTS

1. Prepare a chart which shows the preoperative and postoperative dietary progressions for each of the following operations: appendectomy, gastric resection, colostomy, tonsillectomy, cholecystectomy, obstructive jaundice. Indicate in each instance (1) the approximate length of time each diet is used; and (2) the factors which require particular emphasis.

2. Select any two patients who have just had an operation and note the actual progression of diets in each instance. Note any vomiting or complaints of nausea and distention.

3. Calculate the food value of the gastrostomy tube feeding.

REVIEW QUESTIONS

1. Name five conditions which may require attention in preoperative dietary treatment. What measures can be taken to treat these symptoms?

2. What are some of the problems to consider in planning diets for the patient who has had an operation?

3. Name the ingredients ordinarily used in the preparation of a gastrostomy tube feeding. What contribution does each make to the adequacy of the daily intake? How would you prepare the tube feeding?

4. In what respects does a jejunostomy tube feeding differ from a gastrostomy feeding? Why?

5. Give some specific measures which might be taken to increase the carbohydrate and protein intake before and after operation.

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CHAPTER XXIII

Diet in Fevers and Infections

Fever may be defined as an elevation of temperature above the normal level of 98.6° F., and results from an imbalance between the heat produced in the body and the heat eliminated from the body. Fevers may take place for various reasons amongst which infections are of especial importance. The length and severity of the febrile period depend upon the pathological conditions which have brought about the elevation of temperature. For the purposes of dietary considerations we may class fevers as (1) those of relatively short duration such as tonsillitis, influenza, pneumonia, and scarlet fever; (2) subacute fevers such as typhoid which are of longer duration and more debilitating; (3) chronic fevers such as tuberculosis which may last for months and even years. The diet must be adequate to cover the metabolic needs of the body; it must also be so planned that no harmful foods are included.

Metabolism in Fevers. Fever causes profound changes in metabolism. The extent to which the individuals suffer in such cases depends upon (1) the severity of the infection, (2) the height and duration of the febrile period, and (3) the nutritional status of the patient when the infection occurred. The more important metabolic changes are:

Increased Metabolic Rate. There is an increase in metabolism amounting to 7.2 per cent for every degree rise in temperature[1]; this increase must be compensated by an increase in the energy or caloric intake.

Increased Protein Metabolism. With the increase in the metabolic rate, there will be a like increase in protein losses due to the breakdown of muscle tissues. The additional end products of protein metabolism place a heavy burden on the kidneys, which are called upon for the elimination of these wastes.

Decreased Glycogen Stores. Increased metabolism, no matter

what the cause, brings about a marked decrease in the body's normal glycogen store, which may result in the development of acidosis and other complications.

Dehydration. An increase in the metabolic rate causes a loss of body fluids.

Decreased Motility and Decreased Secretory Processes. These processes, especially in the gastric region, are generally interfered with when infections occur, and the diet must be adjusted to meet these conditions.

Dietary Considerations. The diet in fevers must necessarily depend on existing pathological conditions. In general it should meet the following requirements:

Ease of Digestion. A liquid diet is commonly used at first in order to afford maximum rest to the body and to facilitate ready digestion and rapid absorption, since the depression of gastric activity may slow up the digestive processes. When the fever subsides and the appetite improves it will be possible to gradually add soft foods and then progress to a regular diet.

Intervals of Feeding. Small quantities of food at intervals of two to three hours will permit adequate nutrition without overtaxing the digestive and circulatory system at any one time.

Energy. The bed patient's caloric requirement may be increased by as much as 50 per cent or even more depending upon the temperature, the amount of toxic destruction of tissues, and the amount of restlessness. Thus a normal individual who may need 1800 calories in bed might require 2700 calories or more if he had a fever. The body's need for calories will probably not be met during the height of the fever, but a high caloric diet with intermediate feedings should be used as soon as possible.

Protein. The most easily digested and most efficiently utilized protein foods such as milk and eggs should be used liberally in order to minimize the loss of tissues.

Carbohydrates. Glycogen stores are most efficiently replenished by the inclusion of sugars such as glucose, Karo syrup, and cane sugar. Glucose should be used whenever possible since it is less sweet than many other sugars and more of it can consequently be used. Furthermore it is a simple sugar which is absorbed into the blood stream without the necessity for enzyme action. Lactose is

often used, but it is less desirable since it may increase fermentation and diarrhea.

Vitamins. Increased intake of vitamins A, the B complex, and ascorbic acid is advisable during fevers due to the accelerated body metabolism.

Salt. Since the chloride metabolism is altered, it is necessary to insure a liberal intake of sodium chloride daily. This may be accomplished by the free use of salty broth, although supplementary sodium chloride is sometimes ordered by the physician to be taken by mouth or given intravenously.

Fluid. Beverages of all kinds are used to prevent the loss of body fluids and resulting dehydration.

FEVERS OF SHORT DURATION

There are a number of infectious conditions which are accompanied by a short febrile period, pneumonia being a good example of such fevers. Here the lungs are the seat of infection, the temperature may be very high, and the loss of strength great. The purpose of the diet is to nourish the patient adequately and increase his resistance to withstand the infection.

Modification of the Diet. The diet used during the acute stage is liquid in character and composed of such foods as will furnish the maximum nourishment while imposing the least work for the body. A high-calorie fluid diet answers this purpose. The liquids used must be reinforced with concentrated carbohydrates, and concentrated proteins in the form of eggs and milk. Cream is the best type of fat to be used under the circumstances. As the patient's condition improves the diet is changed to a high-calorie soft diet. The diets outlined on pages 321 and 324 are suitable for patients with acute fevers.

TYPHOID FEVER

Typhoid fever is a condition caused by a specific bacteria which on entering the body attacks the membranes of the intestinal tract causing lesions or ulcers to develop. The intestinal tract becomes highly inflamed and irritable, and diarrhea is a frequent complication. The ulceration may sometimes be so severe that hemorrhage and even perforation of the intestines may occur.

Metabolism in Typhoid Fever. The metabolic rate is considerably increased in typhoid fever, the prolonged febrile period causing a loss of tissue protein sometimes amounting to as much as one half to three quarters of a pound of muscle a day. The body store of glycogen is quickly depleted, and a probable upset in water balance occurs. Fever also lowers the vitamin content of the body. If diarrhea occurs, the absorption of all food constituents is interfered with. Investigations made by Du Bois[2] and Coleman and Gephart[3] showed that the digestion, absorption, and utilization of food by typhoid patients was good, if the diet was properly selected and prepared.

Modification of the Diet. There are certain factors governing the food intake by typhoid fever patients. (1) Because of the inflamed condition of the membranes lining the intestines it is necessary that the food be soft or liquid, and free from irritating substances. (2) Since the heat losses are great the caloric intake may need to be increased to 3500 calories or more per day. (3) The protein intake is raised to 1½ Gm. or more per kilogram of body weight (90 to 110 Gm. daily) to cover the tissue losses. (4) Carbohydrate in the form of glucose is added to replace the lost glycogen. (5) The fluid intake is increased to 3000 cc. daily. (6) The salt intake should be at least 4 Gm. per day.

Since it is practically impossible to administer a high-calorie diet to these patients by giving three meals a day, intermediate feedings including a bedtime feeding are advisable. When fluid diets are used, the intervals of feeding may be shortened to 2 or 2½ hours in order to nourish the patient adequately. Night feedings are used when the diet must be very high in calories. Since a liquid diet becomes very monotonous if continued long, it is advisable to add soft foods which are easy of digestion as quickly as the patient can tolerate them.

Planning the Daily Diet. The routines outlined below are an adaptation of the regimen used at The Presbyterian Hospital in New York City.

HIGH CALORIE FLUID AND SOFT DIET[4]

General rules:

If the patient is too acutely ill during the first few days to tolerate a high-calorie diet, choose foods from the following list and give only as much as the patient can tolerate.

During the acute stage the patient should be visited before each meal. If he suffers from nausea give small amounts frequently, eliminating the cream.

Glucose* is used whenever possible because it is less sweet than sugar, and consequently more of it can be used. Furthermore it is a simple sugar and does not need the action of the digestive enzymes.

Unless the patient is getting sodium chloride in some other form, the diet should include at least 4 Gm. daily.

Egg white may be used in fruit juices and milk to increase the protein intake. Gelatin may also be added to broth and other hot fluids.

Include these foods daily:

4 glasses milk
2 to 4 eggs
1 cup coffee cream
1 serving fine or strained cereal
2 glasses orange, grapefruit, or tomato juice
Other foods selected from below to provide 2500 or more calories

Foods allowed:

Beverages — coffee, tea, Postum, cocoa, and gingerale
Bread, crackers, and cereals — white bread plain or toasted, plain white crackers, any cooked and strained cereal, prepared cereals such as cornflakes, rice krispies, puffed rice
Cheese — cream or cottage
Desserts — cornstarch, tapioca, rice or bread puddings; custard, junket, plain gelatin desserts, plain ice cream, or fruit ice
Eggs — soft cooked, poached, scrambled, or raw in eggnog
Fruit juices — sweetened with glucose if possible
Fruits — ripe banana only
Meat broths and bouillons
Milk — plain, malted, or flavored milk drinks
Vegetables — mashed or baked potato (served without skins); cream soups with strained peas, asparagus, celery, corn, carrot, tomato, or spinach

Foods to avoid:

All fried food
All fruits and vegetables except those listed above
All meats and fish
Coarse dark cereals

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*Glucose may be purchased very inexpensively under various trade names as cerelose or Dyno.

Coarse dark breads
Desserts such as pie and pastry
Rich or strongly flavored cheese
Nuts

TYPE DIET	SAMPLE MENU
Breakfast	
Citrus juice with glucose — 1 glass	Orange juice with glucose
Cereal with cream and sugar	Cream of wheat with cream and sugar
Egg, cooked or poached	Poached egg on
White toast with butter	Buttered white toast
Beverage	Cocoa
Midmorning	
Eggnog	Eggnog made with cream
Luncheon or supper	
Broth or strained cream soup	Cream of tomato soup
Potato with butter	Baked potato without skin
	Butter for potato
White bread with butter	Buttered white toast
Dessert	Vanilla ice cream
Beverage	Milk
Midafternoon	
Citrus juice	Orange juice with egg
Saltines	Saltines
Dinner	
Cream soup or broth	Consommé with gelatin
Egg or cheese	Soft cooked egg
Potato or cereal	Boiled rice with sugar and cream
White bread with butter	Buttered white toast
Dessert	Tapioca cream
Beverage	Milk
Bedtime	
Milk beverage	Chocolate malted milk
Plain pudding, bread, or crackers	Cream cheese sandwich on white bread

Most patients can tolerate the diet outlined above from the beginning of the illness, although they may not necessarily take the full

amounts of food stated. Whenever a more limited diet with fluids only is necessary, the following pattern is suggestive:

HIGH CALORIE FLUID DIET

7:00 A.M.	Cocoa with cream and sugar; or coffee or tea . . .	1 cup
9:30 A.M.	Milk with 1 to 2 tablespoons glucose	1 glass
11:30 A.M.	Orange or grapefruit juice with glucose and 1 egg white	1 glass
1:00 P.M.	Cream of vegetable soup with 1 to 2 teaspoons gelatin	1 cup
3:00 P.M.	Pineapple juice or other fruit eggnog with cream	1 glass
5:30 P.M.	Milk with glucose	1 glass
7:30 P.M.	Orange juice with whole egg and glucose	1 glass
9:30 P.M.	Hot malted milk made with milk and glucose . . .	1 cup

Night feedings may be given if caloric intake is inadequate during the day.

TUBERCULOSIS

Pathology and Metabolism. Pulmonary tuberculosis is an inflammatory disease of the lungs accompanied by a wasting of the tissues, exhaustion, cough, and fever. In its acute form it resembles pneumonia because the temperature is high and circulation and respiration are increased. The metabolic rate in tuberculosis is not particularly high except when the fever is high, but wasting may be considerable because of the length of the illness. A tendency to develop gastro-intestinal disturbances is characteristic of the disease.

Planning the Diet. The dietary treatment of tuberculosis is arranged to cover the three stages of the disease; i.e., acute, subacute, and convalescent. As a rule the caloric intake need not be as high as in typhoid fever, but some increase over the normal requirement is necessary. The calories should be sufficient to maintain ideal weight, but should not be so high that the patient gains in excess of five pounds over the ideal weight for his body build. Most patients maintain satisfactory weight control if they receive 2500 to 3000 calories daily after the high temperature has subsided.

During the acute stage a high-calorie fluid diet is advised. This is followed by a high-calorie soft diet until the condition of the patient warrants the giving of a more liberal diet.

Three meals a day with three intermediate feedings at 10:00 A.M., 2:30 P.M., and at bedtime is the usual procedure. However, there

HIGH CALORIE DIET

(For Patients with a Fever)

Type Diet	Soft Diet	Regular Diet
	Sample Menu	Sample Menu
Breakfast		
Fruit juice, Choice of	Grapefruit, orange, tomato — 1 glass	Same
or		
Fruit, Choice of	Apple sauce, puréed apricots — ⅓ cup with cream and sugar.	Same, or fresh fruit
Cereal	Fine cereal — ½ cup with cream and sugar	Any cooked or ready-to-serve cereal with cream and sugar.
Egg	Soft cooked or poached — 1 egg	Cooked as desired (fried only occasionally) — 1 to 2 with bacon
Bread	Wholewheat as plain. buttered, or milk toast — 1 to 2 slices	Same — 2 to 3 slices or more
Beverage	Cocoa, milk, or coffee made with milk and cream — sugar as desired	Same
Butter	1 square	As desired
Dinner		
Cream soup, Choice of	Tomato, pea, or carrot — 1 cup with 1 to 2 crackers	Any kind of cream soup — 1 to 1⅓ cups with crackers as desired
Meat	Minced chicken on toast — 2 tbsp. chicken, 4 tbsp. cream sauce	Baked chicken, roast lamb, beef, or fish — 1 large serving (3 to 4 oz.)
Potato	Mashed—½ to ¾ cup with butter (1 to 2 tbsp.)	Mashed or boiled — 1 to 2 with butter or gravy
Green vegetables	Puréed or finely chopped spinach or other greens — ⅓ to ½ cup	Spinach, cauliflower, quickly cooked cabbage, or other leafy vegetable — 1 to 2 servings
Salad		Fruit or vegetable with mayonnaise or French dressing
Dessert, Choice of	Apricot or prune whip with cream, tapioca, or ice cream	Fruit whip with cream, or ice cream and sponge cake
Bread	Toasted — 1 to 2 slices	As desired
Beverage	Milk and cream — 1 glass; or buttermilk and cream, cocoa, or tea	Milk and cream or buttermilk and cream or tea
Sugar	To sweeten beverage	To sweeten beverage

HIGH CALORIE DIET (*Cont'd*)

(For Patients with a Fever)

Type Diet	Soft Diet	Regular Diet
	Sample Menu	Sample Menu
Supper Meat, fish or eggs Choice of	Creamed tuna fish on toast, egg scrambled over hot water, scalloped oysters—3 to 4 oz.	Same
Rice or potato	Boiled rice or rice baked in milk, baked potato	Rice boiled, baked in milk, or au gratin; or potatoes in any way — 1 large serving
Green vegetable	Puréed string or Lima beans — ⅓ to ½ cup with butter (1 to 2 tsp.)	Lettuce and tomato salad or any simple salad with mayonnaise
Bread	Toasted — 1 to 2 slices with butter (1 to 2 tsp.)	As desired
Dessert	Apple tapioca or chocolate blanc-mange or fruit sauce — ½ cup with cream	Fresh or canned fruit sauce, tapioca, rice or cornstarch pudding with cream as desired
Beverage	Hot cocoa or tea with cream and sugar or milk and cream (1 part cream, 2 parts milk)	Same
Evening Feeding	Fruit eggnog or chocolate malted milk	Same

are patients in whom the intermediate daytime feedings may so interfere with the appetite as to prevent the taking of a sufficient amount of food at meal time. The bedtime feeding is always used because it does not adversely affect the food intake for the rest of the day.

SUMMARY

Fever is defined as an elevation of temperature above the normal 98.6° F. It is caused chiefly by the invasion of the body by infective bacteria.

Form: Fever may be acute, subacute, or chronic in form; pneumonia is an example of the acute form, typhoid fever of the subacute, and tuberculosis of the chronic form.

Metabolism: Fever causes an increase in the metabolic rate, resulting in a loss of body tissues and reduction of glycogen. Body fluids are lost because of the greater dissipation of water through

the skin. The vitamin content of the body is also likely to be reduced by fever.

Planning the Diet: The type of diets used for fevers of long and short duration are high-calorie fluid and soft diets. Glucose should be used to increase the calories when possible, since this pure carbohydrate is less sweet than ordinary sugar, and may be taken without satiation. The intake of calories daily should be from 2500 to 3500 or more depending upon the height of the fever, the length of its duration, and the extent of tissue losses.

PROJECTS

1. Plan a high-calorie fluid diet for a fever of short duration. Include 2500 calories and 90 Gm. of protein.

2. Plan a high-calorie fluid and soft diet for a patient with typhoid fever. Include 110 Gm. protein and 3500 calories.

REVIEW QUESTIONS

1. Define fever.

2. What is the percentage increase in metabolism brought about by fever?

3. What are the results of the increased metabolism on the body?

4. What dietary modifications are necessary to cover the losses which are brought about by fever?

5. Why is the addition of soft food in the diet of typhoid fever patients advisable?

6. How would you go about preventing and overcoming a state of dehydration caused by fever?

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CHAPTER XXIV

Diet in Gastric Disturbances

The health of the body is only as good as the health of the individual organs. Thus the gastro-intestinal tract on which the entire body depends for adequate nourishment assumes a most essential role in the maintenance of body health. The stomach is the first important organ of digestion, since the food stays for too short a time in the mouth to accomplish much by way of adequate preparation. Therefore, any impairment of this organ, either functional or organic, must necessarily interfere with the body's nutritional status.

Functions of the Stomach. The work of the stomach is accomplished by secretory and motor activity. The secretory processes include the production of gastric juice, the chief constituents of which are hydrochloric acid and the protein-splitting enzyme pepsin. The functions of this secretion are to partially digest the protein and to assist in the splitting up of the food materials. Free hydrochloric acid serves as a key to the valve which divides the stomach from the duodenum, thus regulating the passage of thick chyme into the small intestine. The contraction and relaxation of the muscular walls of the stomach, and the peristaltic waves which assist in mixing the food mass with the stomach juices constitute the motor activity of the stomach. These combined secretory and motor processes change the ingested food into a thick homogenous mass known as chyme. The more efficiently they are carried on, the better the gastric digestion. There is another important material resulting from normal gastric juice, namely the so-called "intrinsic factor"[1] which is essential for the formation and ripening of the red blood cells.

Disorders of the Stomach. Gastric disturbances are both organic and functional in character. Peptic ulcer and carcinoma of the stomach are the best examples of organic disorders. Functional disturbances, which present no pathologic lesions, may be traced to

modified secretory and motor activity. Hyperchlorhydria and hypochlorhydria are examples of abnormal secretory function, while gastric atony represents a definite impairment of the motor activity. Quite frequently, modifications of motor and secretory activity are accompaniments of the more serious organic diseases. Gastric disorders may occur as a complication in other diseases such as tuberculosis, disturbances of the liver and gallbladder, and in kidney diseases.

Role of Diet in Diseases of the Stomach. Diet is an essential factor in the treatment of (1) gastric or duodenal ulcer, either simple or complicated with hemorrhage, (2) acute or chronic gastritis, and (3) gastric atony. All of these disturbances require special modifications of the normal diet. It must be remembered that deficiencies will occur unless the essential needs of the body are covered in the diet, and that the purpose of these diets is to rest the stomach, and to provide foods which will nourish the patient without aggravating the existing pathological conditions. The dietary modifications are dependent upon the type of disease present.

PEPTIC ULCER

Of the gastric disturbances to be discussed here, peptic ulcer is the most important. The development of ulcers in the stomach or duodenum is not at all uncommon. Individuals of nervous temperament not only develop them frequently, but are likely to have flare-ups when under strong emotional stress even after the ulcer has healed. Instability of the nerves, and worry or sudden shock favor the development of ulcers in both men and women. Any effective treatment must be based upon the fundamental principles of physiology and chemistry of the body, and upon prompt recognition of the symptoms.

Pathological Conditions. The exact cause of peptic ulcer is unknown. For some unexplained reason, the mucosa of the stomach or duodenum becomes unable to resist the action of the digestive juices. Part of the tissue is digested away and an ulcer develops. According to Andresen[2], gastric ulceration is an acute process healing rapidly and spontaneously, and each new attack of symptoms indicates the development of a new ulcer. This concept makes one realize that ulcers which do not yield promptly to treatment are the

ones with complications. Practically all patients with ulcers present these typical symptoms:

1. Gastric tone is increased with deep hunger contractions occurring when the stomach is empty. Characteristic gnawing pains make their appearance two to three hours after meals or in the middle of the night. Relief is usually prompt when one takes food or alkalies.

2. The volume and concentration of hydrochloric acid secreted is increased.

3. The gastric mucosa is sensitive to irritating substances such as strong acids, coarse fiber, and condiments.

4. Distention following ingestion of quantities of fluid or solid food is a common finding.

Modifications of the Diet. The primary principle for the treatment of ulcers is physical and mental relaxation, and the next important principle is correct dietary treatment. The objectives of the diet are (1) to maintain good nutrition, and (2) to provide opportunity for the ulcer to heal by (a) dilution of the stomach contents with meals at frequent intervals, (b) giving small meals to avoid distention, and (c) providing bland, non-irritating foods to avoid chemical or mechanical irritation. These objectives are attained when special consideration is given to the following modifications:

Adequate Nutrition. The daily dietary allowances for the nutrients are those for the normal individual. If malnutrition has occurred as a result of prolonged illness it is necessary to give increased amounts of protein, calories, minerals, and vitamins. Special consideration should be given to liberal allowances of ascorbic acid and the B vitamins. The customary Sippy diets and bland diets are apt to be low in thiamine. Liberal allowances of enriched cereals or of brewer's yeast will help to correct this.

Character of the Food. In addition to providing nourishment, correctly chosen foods perform two functions in treatment of ulcers. They neutralize the acid in the stomach, and they minimize the flow of gastric juice. Protein foods as milk, eggs, and meat combine effectively with acid to neutralize the latter. The extractives in meat, however, tend to stimulate gastric flow, so that it is customary to use only milk, eggs, and mild cheese during the early stages of treatment.

Easily digested fats delay evacuation of the stomach with an accompanying reduction in peristalsis, and motility. Cream is especially effective in reducing the flow of acid, the degree of peristalsis, and the motility. Bulky, fibrous foods, and highly seasoned foods, on the other hand, promote secretion of acid and stimulate peristalsis. The latter foods should therefore be avoided.

Amount of Food. Since distention with accompanying pain is a frequent complaint of the patient with ulcers, no single feeding should be so large that pressure on the stomach walls with subsequent discomfort results. During the early stages of treatment the feedings are usually limited to two ounces. Gradual increases in amounts of food are made from time to time.

Intervals of Feeding. Constant dilution of the stomach contents and maintenance of neutrality is essential. Punctual feedings at one- and then two-hourly intervals is important during the first days of care. By the time the patient has progressed to a bland diet six meals a day are generally sufficient.

Planning the Daily Diet. Outlines are given below for the modified Sippy regimen used in the first two weeks of treatment and the bland low cellulose diet for subsequent use. These diets are adaptations of those used at the Presbyterian Hospital in New York City.[3]

MODIFIED SIPPY DIET

General rules:

Foods must be served in small quantities at intervals of 1 to 2 hours according to the patient's tolerance for food.

Feedings are given from 6 or 7 A.M. to 9 or 10 P.M. and during the night if the patient is awakened by pain.

Milk, or milk and cream, is the only food allowed during the first three days of treatment.

If progress is satisfactory, bland, non-irritating, non-stimulating foods are added each day until the patient has progressed to a bland low-cellulose diet with three meals and intermediate feedings.

The usual progression requires 13 days before the full bland diet is given, but advancement may be more or less rapid depending on the progress which the patient is making.

Foods allowed:

Beverages and soups — weak cocoa and cream soup made from strained vegetables (see vegetable list on page 332).

Breads, crackers, and cereals — farina, Cream of Wheat, Ralston, Pablum, strained oatmeal, strained Pettijohns, rice, macaroni, and spaghetti;
white bread toasted without crusts
plain white crackers

Butter

Cheese — cream or cottage

Desserts — custard, junket, plain gelatin desserts; vanilla, chocolate, or caramel blanc mange; ice cream

Eggs — soft cooked, poached, scrambled, or as eggnog

Fruits — strained orange, grapefruit, and tomato juice; strained cooked or canned apples, peaches, plums, prunes, apricots

Meats — ground tender chicken, lamb, beef, veal, or fresh fish

Vegetables — cooked and strained asparagus tips, beets, carrots, peas, squash, spinach, string beans, sweet potato; white potato, any way except fried

Sugar — in small amounts

Salt — enough to make food palatable

Foods to avoid:

All foods not listed above. Note especially that the following must not be allowed: bouillon, meat broths, carbonated beverages, coffee, condiments, spices, tea

TYPE DIET—DAILY ADDITIONS FOR 13 DAYS

First and second day	60 cc. ($\frac{1}{3}$ glass) 10 per cent cream every hour from 6 or 7 A.M. to 9 or 10 P.M. Continue during the night if the patient is awake.
Third day to thirteenth day inclusive	120 cc. ($\frac{2}{3}$ glass) 10 per cent cream every two hours given during the day and night as above. Beginning with the fourth day plan three of the feedings to correspond with the time of the three meals as indicated below. Select the foods from the list given above.

DAY	BREAKFAST	LUNCHEON	DINNER
4	Cereal — $\frac{2}{3}$ cup Sugar — 1 teaspoon	Cereal — $\frac{2}{3}$ cup Sugar — 1 teaspoon	Cereal — $\frac{2}{3}$ cup Sugar — 1 teaspoon
5		Cream soup — $\frac{2}{3}$ cup	Potato — 1 serving Butter — 1 teaspoon
6	Allow two saltines or soda crackers and 1 teaspoon butter with the cream given at 10 A.M., 2 P.M., and 8 P.M. The cream may be flavored with cocoa if desired.		

DAY	BREAKFAST	LUNCHEON	DINNER
7	Toast — 1 slice Butter — 1 teaspoon	Toast — 1 slice Butter — 1 teaspoon	Toast — 1 slice Butter — 1 teaspoon
8	Soft egg — 1	¼ glass orange or grapefruit juice with ¼ glass water	Dessert
9		Soft egg — 1 *or* Cheese — 1 ounce (omit cereal and sugar)	
10		Potato — 1	Strained vegetable (omit cereal and sugar)
11	Strained fruit	Orange or grapefruit juice — ¼ glass (½ glass in all omitting the water)	
12			Ground meat
13			Tomato juice — ½ glass
14	Progress to the bland low cellulose diet described below		

To illustrate the use of the above pattern, a typical menu for the tenth day is given:

Breakfast

Soft cooked egg
Buttered white toast
Strained oatmeal with sugar
Weak cocoa made with ⅔ glass cream

10 A.M.

Cream — ⅔ glass
Buttered soda crackers — 2

Luncheon

Cream of tomato soup
Poached egg on toast
Baked potato with butter (No skin)
¼ glass orange juice mixed with ¼ glass water

2 P.M.

Cream — ⅔ glass
Small cream cheese sandwich (white bread)

Supper

Mashed potato with butter
Strained asparagus
White toast with butter
Butterscotch pudding
Cream — ⅔ glass

7 P.M.

Cream — ⅔ glass

9 P.M.

Cream — ⅔ glass
Buttered soda crackers — 2

BLAND LOW CELLULOSE DIET

(With six feedings)

General rules:

Feedings are given in three meals with three intermediate feedings

Only small amounts of food should be eaten at each meal.

The patient should be urged to eat slowly and to chew his food well.

Cheerful surroundings and freedom from worry and emotional upsets, particularly at meal times, are of vital importance.

Rest before and after meals is essential.

An additional source of the B complex vitamins should be provided. Brewer's yeast is an excellent source.

Include these foods daily:

4 glasses milk

1 serving (3 ounces) meat, fish, or fowl — ground unless very tender

2 eggs, or 1 egg and a substitute of soft cheese, milk, meat, or fish

3 servings (1 ounce) butter

2 servings strained whole-grain or enriched cereal or fine whole-grain or enriched bread

2 servings strained fruit

$\frac{1}{2}$ glass orange, grapefruit, or tomato juice

1 serving strained vegetable in addition to 1 or more servings potato, strained corn

Other foods as allowed in the following list to provide adequate calories

Foods allowed:

Beverages and soups — weak cocoa and cream soups

Breads, crackers, and cereals — day old white, fine wholewheat, or rye bread without seeds; white crackers; dry cereals such as cornflakes, Rice Krispies, puffed rice; fine cooked cereals such as farina, Cream of Wheat, Ralstons, cornmeal, hominy grits, rice, noodles, spaghetti, macaroni; strained coarse cereals such as oatmeal, Pettijohns, and wholewheat cereal

Cheese — mild soft cheese such as cream and cottage; mild American cheese when used in sauces

Desserts — custard, junket, plain gelatin desserts; cornstarch, rice, bread, or tapioca puddings; plain cake, cookies, ice cream

Eggs — any way except fried

Fruit — strained cooked or canned apples, pears, peaches, prunes, plums, or apricots; banana, ripe; strained orange, grapefruit, pineapple, apple, prune, or tomato juice

Meat — beef, veal, lamb, liver, fowl, fish, oysters, canned salmon, and tuna without bones, gristle, and excessive fat — all ground unless very tender

Milk — plain or flavored

Vegetables — strained and cooked asparagus, lima beans, string beans, beets, carrots, celery, chard, corn, peas, pumpkin, sweet potato, spinach, squash, tomato; white potato — any way except fried

Miscellaneous — plain candy, jelly, syrup, honey, molasses, sugar, salt — all to be taken in moderate amounts if well tolerated

Foods to avoid:

Beverages and soups — strong coffee, tea, chocolate, and highly flavored carbonated drinks; all meat soups

Breads, crackers, and cereals — coarse dark cereal unless strained; whole-grain crackers; coarse dark bread; fresh bread

Cheese — strongly flavored

Desserts — rich pastries and any dessert containing nuts and whole fruit

Fruit — raw fruit except juice and ripe banana

Meat — salted and smoked meat and fish; pork; gristle and fat

Vegetables — all raw and coarse vegetables; strongly flavored such as cabbage, cauliflower, broccoli, cucumber, onion, turnip, Brussels sprouts, green pepper

Miscellaneous — seasonings, spices, condiments as mustard, catsup, chili sauce, horseradish, Worcestershire sauce, vinegar, olives, pickles; fried food, rich gravies, and sauces; nuts

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit juice, strained fruit, or ripe banana	Strained prunes
Strained whole-grain cereal	Ralstons with milk and sugar
Milk and sugar	
Egg	Soft cooked egg
Toast with butter	Enriched bread, toasted with Butter
Beverage	Coffee with half milk
Midmorning	
Milk — 1 glass	Milk — 1 glass
Soda crackers — 2	Soda crackers — 2
Luncheon or supper	
Egg or substitute of mild, soft cheese, or tender meat, or fish	Scrambled egg
White potato (without skin), rice, noodles, spaghetti, or macaroni	Buttered rice

TYPE DIET *(Continued)*	SAMPLE MENU *(Continued)*
Luncheon or supper (Continued)	
White bread with butter	Enriched white bread with butter
Strained fruit	Applesauce
Milk	Milk
Citrus juice — ½ glass	Orange juice — ½ glass
Midafternoon	
Milk — 1 glass	Milk — 1 glass
Plain cake or cookies	Angel food cake
Dinner	
Tomato juice — ½ glass	Tomato juice — ½ glass
Tender meat, fish, or fowl	Broiled lamb chop
White potato without skin	Mashed potato
Strained vegetable	Strained beets
White bread with butter	White bread with butter
Dessert	Vanilla ice cream
Milk	Milk — 1 glass
Evening nourishment	
Milk — 1 glass	Milk — 1 glass
Plain cake, cookies, or white crackers	Arrowroot cookies — 3

Prophylactic Measures. It has been found that ulcers, both uncomplicated and complicated, have a tendency to flare up even after complete healing has taken place. The danger of a recurrence is an ever present one. Nervous excitement and sudden shock or grief have a tendency to activate the ulcer and frequently cause gastric hemorrhage. It is better to take precautions to prevent such occurrences instead of waiting until the damage has been wrought.

A patient who has had ulcers should usually remain on the bland low-cellulose diet for six months or longer. Dietary indiscretions must be avoided at all costs. New foods should be added one at the time and with caution. While the selection of foods which shall constitute the diet is of utmost importance it is equally vital to stress the mode of living. Adequate rest is a key point in treatment and should include a rest period before and after meals. Irregularity and haste in eating are serious hazards to continued success of the regimen. It is essential to stress to the patient not only *what* he shall eat but also *how* he shall eat.

Alvarez[4] has emphasized the importance of prompt and strenuous treatment after psychic strain in order that flareups of the ulcer may be avoided. The stomach tends to be empty of food but full of highly acid gastric juice from 10 P.M. to 3 A.M., and it is likely that this is the period when the greater part of the injury to the gastric and duodenal mucosa occurs. Following any emotional strain such as grief or worry it is advisable to use a continual antiacid drip during the night for one or two nights according to Alvarez. In place of the continuous drip the patient may partake of food every two hours from dinner time until two or three o'clock in the morning.

BLEEDING ULCER

The dietary treatment used in bleeding ulcer of the stomach or duodenum has undergone considerable change in the past few years. The older starvation regimen has given place in large measure to a more logical provision of food so that the highly concentrated stomach juices act upon the food rather than upon the blood which under the circumstances would be digested and so prevent a blood clot from forming.

The bleeding peptic ulcer is probably caused by erosion of the artery lying at the base of the ulcer. The clotting of the blood is the only means of closing the opening in the blood vessel. Effectual sealing of the vascular wound is furthered by the retraction of the open end of the artery.

Dietary Treatment of Bleeding Ulcers. The use of food in the treatment of bleeding ulcers is based on the principle of reducing the number and violence of stomach contractions by providing small, frequent feedings of easily digested foods. The gastric juice is given something other than the ulcer on which to act. The change in the method of feeding in such cases has made the healing of the ulcer more rapid thus shortening the hospital stay, and has also lowered the death rate quite considerably.[6]

There are two dietary regimens outlined here both of which have been successful in the treatment of bleeding ulcers. The purpose of the diet in each instance is to rest the stomach, and to enable the ulcer to heal by providing small feedings at frequent intervals so that contractions are slower and less violent. These diets are

known by the doctors who originated them; they are the Andresen diet and the Meulengracht diet.

ANDRESEN DIET[5]

General rules:

Gelatin is combined with milk since it promotes very fine curd formation. Gelatin also provides effective material for neutralization of the acid.

The gelatin-milk mixture is given in 6 ounce quantities at 2 hour intervals for 8 days.

The formula is given warm or cool, plain or flavored.

The formula is made fresh every 12 hours. It is kept cool, but, in order to prevent gelling, it is not put into the refrigerator.

Selected foods are added to 4 feedings beginning with the fifth day.

The diet progresses to a bland low-cellulose regimen without meat, chicken, or fish by the ninth day.

While the diet was arranged primarily for the treatment of bleeding ulcers, it may be used with equal success for the cases of uncomplicated ulcers.

Composition of the formula:

Gelatin-Milk Mixture

Gelatin	30 Gm.
Dextrose	60 Gm.
Cream, 20 per cent	100 Gm.
Milk	900 Gm.

Gelatin-Water Mixture (Used when the patient cannot tolerate the gelatin-milk mixture)

Gelatin	30 Gm.
Dextrose	90 Gm.
Juice of 2 oranges	
Water	1000 Gm.

Foods allowed after fourth day:

1 egg, soft cooked or poached
Fine cereal, average serving
Custard, average serving
Jello or ice cream, average serving

SCHEDULE BEGINNING WITH FIFTH DAY*

DAY	BREAKFAST	MID-MORNING	DINNER	SUPPER
5	1 soft egg	½ cup jello	⅔ cup strained cereal	⅔ cup strained cereal
6	1 poached egg	½ cup jello	⅔ cup strained cereal	⅔ cup strained cereal
7	1 egg ⅔ cup strained cereal		½ cup jello ⅔ cup strained cereal	⅔ cup strained cereal ½ cup ice cream
8	1 egg ⅔ cup strained cereal		⅔ cup strained cereal ½ cup custard	1 egg ½ cup jello
9	Progress to bland low cellulose diet without meat, chicken, or fish. (See pages 334–6.)			

*The feedings of gelatin-milk mixture are, of course, continued throughout the entire regimen.

MEULENGRACHT DIET

Modification by Schiff[6]

General rules:

Feedings are given at 2-hour intervals beginning at 8 A.M. and continuing until 8 P.M.

Milk and water in 5-ounce quantities are allowed if patients desire.

No meat is allowed for the first two days after the hemorrhage.

Patients are allowed up after the third week if progress is satisfactory but the diet is continued for 6 months or more.

Foods allowed:

Vegetable purées — asparagus, beets, carrots, spinach, potato, tomato, squash

Fruit purées — apricots, apple, peaches, pear, prunes, and orange juice

Cereals, strained — oatmeal, Cream of Wheat, farina, cornmeal, hominy, Wheatena

Breads — white, plain or toasted with butter; milk toast; plain white rolls, toasted; soda crackers, graham crackers, arrowroot crackers; zwieback; vanilla wafers

Puddings—baked custard; cornstarch, rice, tapioca, or bread pudding; plain jello; vanilla or chocolate ice cream

Meats — scraped or ground beef balls, broiled; minced lamb; minced lamb chop, broiled; baked or creamed fish; minced liver or chicken

Beverages — milk, milk and cream, buttermilk, tea, cocoa, eggnog

MEULENGRACHT TYPE DIETS

First and Second Days

Breakfast, 8 A.M.

Orange juice — 2 tablespoons
Bread — 1 small slice
Butter — 2 teaspoons
Milk — $\frac{1}{3}$ cup
Cream — $\frac{1}{3}$ cup

Midmorning, 10 A.M.

Eggnog — 1 glass
  Milk — $\frac{3}{4}$ cup
  Egg — 1
  Sugar — 1 teaspoon
Soda cracker — 1
Butter — 1 teaspoon

Dinner, 12 M.

Vegetable purée — $\frac{1}{4}$ cup
Pudding — $\frac{1}{2}$ cup
Cream — 2 tablespoons
Orange juice — 2 tablespoons

2 P.M.

Eggnog — 1 glass
Buttered soda cracker — 1

4 P.M.

Milk — $\frac{1}{3}$ cup
Cream — $\frac{1}{3}$ cup
Fruit purée — $\frac{1}{4}$ cup
Pudding — $\frac{1}{2}$ cup
Cream for pudding — 2 tablespoons

Third Day On

Breakfast, 8 A.M.

Orange juice — 2 tablespoons
Strained cereal — $\frac{1}{3}$ cup
Cream — $\frac{1}{4}$ cup
Toast — 1 thin slice
Butter — 2 teaspoons

Midmorning, 10 A.M.

Eggnog — 1 glass
Soda cracker — 1
Butter — 1 teaspoon

Dinner, 12 M.

Minced meat — $\frac{1}{4}$ cup
Mashed potato — $\frac{1}{2}$ cup
Vegetable purée — $\frac{1}{4}$ cup
Toast — 1 thin slice
Butter — 2 teaspoons
Fruit purée — $\frac{1}{4}$ cup
Milk — $\frac{1}{3}$ cup
Cream — $\frac{1}{3}$ cup
Orange juice — 2 tablespoons

2 P.M.

Eggnog — 1 glass
Buttered soda cracker — 1

4 P.M.

Milk — 1 glass
Chocolate paste — 4 teaspoons

MEULENGRACHT TYPE DIETS *(Continued)*

First and Second Days

Supper, 6 P.M.

Bread — 1 small slice
Butter — 2 teaspoons
Fruit purée — $\frac{1}{4}$ cup
Pudding — $\frac{1}{2}$ cup
Cream for pudding — 2 tablespoons
Milk — $\frac{1}{3}$ cup
Cream — $\frac{1}{3}$ cup

8 P.M.

Eggnog — 1 glass
Buttered soda cracker — 1

Third Day On

Supper, 6 P.M.

Cottage cheese or minced meat — $\frac{1}{4}$ cup
Bread — 1 thin slice
Butter — 2 teaspoons
Pudding — $\frac{1}{2}$ cup
Cream — 2 tablespoons
Milk — $\frac{1}{3}$ cup
Cream — $\frac{1}{3}$ cup
Orange juice — 2 tablespoons

8 P.M.

Eggnog — 1 glass
Buttered soda cracker — 1

OTHER GASTRIC DISTURBANCES

Practically all disorders common to the stomach are traceable to one or more of the following factors: (1) disturbed secretory processes; (2) disturbed motility and tone; and (3) errors in diet. Of the three factors, dietary errors are probably most important since the first two may be caused by bad food habits. Gastritis and gastric atony are the two common disorders in which diet is the most important factor.

GASTRITIS

Pathological Conditions. Gastritis may be accompanied by an excess secretion of hydrochloric acid in the gastric juice (hyperchlorhydria), or by a deficient secretion of hydrochloric acid — and possibly pepsin — in the gastric juice (hypochlorhydria). Gastritis is primarily a functional disorder in which nerve control of the digestive processes becomes out of order. As a rule hyperchlorhydria is more frequently present than a deficiency of hydrochloric acid. The tone of the organ becomes impaired. Hyperacidity (sour stomach) may be caused not only from an excess of free hydrochloric acid but also from products of fermentation of carbohydrates allowed to remain in the stomach for too long a time. Flatulence so often suffered by nervous individuals is caused primarily by the abnormal swallowing of air, and may cause both distress and pain.

Modifications of the Diet. Whatever the cause, the treatment of these disturbances is chiefly dietary. The purpose of the diet is: (1) to provide adequate nutrition without overfeeding; (2) to reduce the secretion and high concentration of hydrochloric acid, or — in case of a deficiency of normal acid content of the gastric juice or of the gastric enzymes — to stimulate the flow of gastric juice; (3) to stimulate the tone of the stomach when that is indicated. To accomplish these goals it is necessary to (1) correct the errors in diet and to improve the food habits; (2) maintain a normal flow and composition of the gastric juice by avoiding all irritating and stimulating foods in cases of hyperchlorhydria, and by avoiding the depressing action of fats in instances of hypochlorhydria.

In hyperchlorhydria it is desirable to increase the fats in the form of cream and egg yolk since these foods have a tendency to inhibit or depress the secretion of acid. Easily digested protein foods are also advantageous because they combine well with the acids in the stomach and prevent an excess of free acid. The diet for hyperchlorhydria, then, is practically the same as that used in the treatment of uncomplicated gastric or duodenal ulcers. The bland low-cellulose diet (page 334) which reduces mechanical and chemical stimulation and irritation to a minimum is ideal for this condition.

When gastritis is accompanied by a deficiency of hydrochloric acid, it will usually prove to be secondary to some other disturbance such as pernicious anemia or pellagra. In such instances the diet is planned to cover the needs of the main disorder rather than the hypochlorhydria as such. The following factors should be noted in the dietary management of the hypochlorhydria: (1) Long fibered foods must be omitted because they have a tendency to delay the emptying of the stomach and so give a greater opportunity for bacterial activity. (2) Fats are reduced in the diet because they depress the secretion of the already deficient acid. (3) The vitamin intake is increased in an attempt to improve the tone of the stomach and to aid in normal digestion. The bland low-cellulose diet used for the ambulatory ulcer patient is again desirable. However, the fat content of this diet should be kept at a minimum and the vitamin intake should be emphasized.

GASTRIC ATONY

Pathological Conditions. Gastric atony is characterized by lack of normal tone of the muscles of the stomach. The contractions are not of sufficient strength to move the food mass out of the organ at a normal rate. Larger pieces or fragments of food are not adequately disintegrated and mixed with the stomach juices.

Atony, like other stomach disorders, is frequently a complication of some other disease and the treatment must be planned with the primary disease and the atony both in mind.

Modifications of the Diet. The objectives of the diet are: (1) to build up the tone of the organ by increasing the intake of vitamins and by the use of foods which stimulate peristaltic action; (2) to avoid foods which stay long in the stomach and delay emptying time of the organ. Foods which contain much coarse fiber will delay the emptying of the stomach and should be avoided. Likewise, fats inhibit stomach activity and should be limited to those which are highly emulsified and which are the carriers of the fat soluble vitamins — eggs, cream, and butter, for example. Small frequent feedings are given in order that the food may pass out of the stomach as quickly as possible, thus eliminating some of the chances for excessive fermentation. The bland low cellulose diet (page 334) is suitable for this condition. Its fat content should be kept low and its vitamin content should be increased. The use of vitamin concentrates may be indicated by the patient's physician.

SUMMARY

The majority of stomach disorders are traceable more or less to one or more of the following factors: (1) errors in diet; (2) disturbed secretory processes; or (3) disturbed tone and motor activity.

Gastric disorders are either functional or organic. Functional disturbances are gastritis — either hyperchlorhydria or hypochlorhydria — and atony. They may also be part of the symptoms of organic diseases. Gastric or duodenal ulcers and carcinoma of the stomach are examples of organic disorders.

Impairment of the nervous system is quickly reflected in gastric disorders. Highly strung individuals are more prone to develop

stomach disturbances than those of a more placid, less emotional type. Moreover, individuals of nervous temperament are more likely to suffer flareup of ulcers under stress or shock than persons of less excitable nature. The former should, therefore, be ever on the watch for recurrence of the ulcer and take measures to prevent their development before the condition becomes complicated.

Uncomplicated ulcers heal rapidly and spontaneously. When the symptoms do not disappear quickly under dietary treatment it is evident that some complication is blocking the healing.

The Sippy diet is the most universally used treatment for uncomplicated ulcers, and the Andresen or Meulengracht regimens are successfully used for bleeding ulcers. In the ambulatory stage the bland low cellulose diet is suitable. These diets all stress the importance of small feedings of non-stimulating, non-irritating foods which are given at frequent intervals. The mechanical irritation of the ulcer by coarse fibers is avoided, while the flow of gastric juice is minimized by omitting such stimulants as meat extractives, condiments, coffee, alcohol, or tobacco. The frequent feedings are effective in dilution and neutralization of the acid in the stomach.

Hyperchlorhydria is usually a symptom of peptic ulcer, but it may also be merely a functional disorder. Whenever it occurs, a bland low cellulose diet given in frequent small meals is used. Easily digested fats such as cream and egg yolk are given in increased amounts since these fats are depressants of acid secretion.

Achlorhydria or deficiency of hydrochloric acid may be functional or it may be a symptom of pellagra or pernicious anemia. The diet in this instance should be a bland low cellulose diet with limitation of the fat and an increase of the vitamin intake.

Gastric atony is greatly decreased motor activity of the muscular walls of the stomach. The diet used is the same as that indicated for achlorhydria.

PROJECTS

1. Calculate the protein, caloric, and vitamin values for the eleventh day of the Sippy regimen.

2. Plan a day's diet for a patient with bleeding ulcer using the Meulengracht regimen (third day). Calculate this diet for protein and calories.

3. Plan a bland low-cellulose diet with decreased fat content. Plan one with an increased fat content.

REVIEW QUESTIONS

1. Name the chief factors in the development of gastric diseases.

2. What diseases of the stomach come under the head of functional disturbances?

3. Name some of the diseases of the stomach that are of organic origin.

4. What stomach disorder is likely to be accompanied by an excessive secretion of hydrochloric acid? Which ones are accompanied by a reduction or absence of the hydrochloric acid?

5. List the principles in the treatment of gastric and duodenal ulcers, and give the reasons for the dietary modifications.

6. What are the chief characteristics of the two diets commonly used in the treatment of bleeding ulcers? Why is the feeding of the patient with a bleeding ulcer considered preferable to the initial starvation regimen?

7. Name some foods and materials which stimulate acid secretion. Name some which depress the secretion of acid in the stomach.

8. Which class of foods is most effective in neutralization of the stomach contents?

9. How long should the diet for gastric or duodenal ulcer be continued after the ulcer has healed?

10. What precautions should be taken by individuals of a highly nervous temperament in conditions of shock or emotional strain to prevent flareups of former ulcers?

11. What are the characteristics of gastric atony?

12. List the necessary modifications of the diet in each of the following conditions: hyperchlorhydria, hypochlorhydria, gastric atony. Give the reasons for each modification.

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CHAPTER XXV

Diet in Diseases of the Intestinal Tract

CONSTIPATION

There is probably no more common disorder than constipation. Few people seem to be entirely immune to this disturbance in some form. Constipation cannot be exactly defined, for certain variations in frequency of bowel movement and completeness of evacuation are entirely physiological. Most people have a bowel movement daily, but for some individuals an evacuation every other day is entirely normal. If a person has eaten little if any food for two or three days it is not reasonable to expect daily elimination, since there will be very little material collected in the large intestine. The most important factor for well being is the maintenance of regular elimination at intervals consistent for the individual. The principles to be described here will be better understood if the student reviews the functions of the large intestine (Chapter X).

Causes. The causes for constipation are many and varied, some of the most important being:

1. Bad food habits. Some diets contain too little bulk (cellulose) and consist largely of concentrated and refined foods which leave little if any residue upon reaching the colon. An insufficient intake of fat leads to inadequate lubrication of the intestinal tract. Lack of vitamin B_1 may be responsible for poor muscle tone.

2. A limited intake of fluids causing the feces to become dry and hard and more or less difficult to eliminate.

3. Poor personal hygiene in which one neglects to respond to the urge for defecation.

4. Lack of exercise. The muscles controlling the movements in the intestines, the colon especially, become weak and lack the essential power to move the fecal mass into the colon so that normal evacuation is delayed.

5. Excessive or long continued use of cathartics, laxatives, and

enemas, which tend to deprive the muscles of the intestinal walls of their essential exercise, thus allowing them to weaken and lose tone. The constant use of such treatment may also irritate the mucosa which lines the alimentary tract, resulting frequently in the development of intestinal spasms or spastic constipation.

6. Nervous disturbances of various sorts. Excitement developed by mental patients at times prevents the bowel from emptying itself for days or even longer. Nervous contractions of the musculature may be caused by irritation and brought about by overstimulation. People living under extreme tension or who are prone to be neurotic frequently develop spastic constipation.

Treatment of Constipation. The treatment of constipation depends entirely upon the type of the existing disturbance. There are two types of constipation which are affected by diet, namely, (1) atonic constipation in which there is lack of tone, and (2) spastic constipation characterized by excessive tonicity. Obstructive constipation is not primarily a dietary problem. In all types of constipation it is necessary to increase the intake of water, have regular meal hours, and a regular time for bowel movement. Placid individuals living a sedentary life, taking little exercise, eating highly concentrated foods, and drinking an insufficient amount of water must learn to change their food habits. Likewise, highly nervous individuals need to be taught how to relax, to avoid substances which have a tendency to irritate the lining of the intestines, and to observe regular habits.

ATONIC CONSTIPATION

Atonic constipation is the most common type of constipation. It seems to be growing less prevalent, possibly due to the vast amount of nutritional education being disseminated in the country today.

Pathological Conditions. In atonic constipation the intestinal walls lack muscular tone and become unable to propel the food mass at a normal rate down the tract, or to move the feces into the rectum. The peristaltic action becomes impaired and fails to work with the other motor processes throughout the entire tract. Bacterial action may be greatly increased due to the stagnation of material in the colon, and possibly the products of this action may be responsible for at least some of the symptoms usually occurring as

a result of constipation. When the diet is composed of too highly refined foods, absorption may be so complete that there is too little left to stimulate the passage of food down the tract.

The chief causes of atonic constipation are selection of foods low in bulk, insufficient fluids, poor personal hygiene, lack of exercise, or excessive use of cathartics or enemas. The common symptoms of this disturbance include headache, malaise, bad taste in the mouth, and foul breath.

Modifications of the Diet. The object of the dietary treatment is to encourage regular elimination from the bowels by stimulating peristalsis and improving the tone of the muscular walls of the tract, especially of the colon. It must be clearly understood that the diet for atonic constipation is a *normal adequate diet* in which the fiber, vitamin, mineral, and fluid intakes are especially stressed. The diet which emphasizes these factors is sometimes referred to as a "High Vitamin, High-Cellulose Diet."

The normal mixed diet contains an average of 5 to 6 Gm. of cellulose, whereas the diet used in the treatment should contain 10 Gm. or more of fiber daily. The additional cellulose or fiber is provided by four servings of fruits and vegetables which are known to be rich in vitamins and minerals as well. Raw vegetables and fruits are especially valuable in the treatment of this particular type of constipation.

Individuals suffering from atonic constipation are not infrequently overweight, and a reduction of weight may be indicated as part of the treatment.

Planning the Daily Diet. The dietary regimen suggested here is a normal diet with an increased intake of cellulose, vitamins, minerals, and fluids.

HIGH VITAMIN HIGH CELLULOSE DIET

General rules:

The diet is a normal one with supplements of fruits, vegetables, and whole-grain cereals for additional cellulose, vitamins, and minerals.

Fluids should be forced to 8 or 10 glasses daily.

If the patient does not drink adequate water, fruit juices or buttermilk may be given between meals.

If it is not possible to obtain sufficient residue in the diet, agar-agar, a type of seaweed which is not affected by intestinal en-

zymes, may be given since it absorbs water and thus supplies the necessary bulk. This may be taken dry and swallowed with water; it may be sprinkled on cereal; or it may be used in place of gelatin for the preparation of a dessert.

Mineral oil dressings should not be used as they interfere with absorption of vitamin A. Mineral oil may be given at bedtime if so prescribed by the physician.

Emphasis must be placed on good health habits; that is, a regular time for elimination, adequate rest and relaxation, and regular time for meals.

If the individual is overweight, a low-calorie diet should be instituted.

Include these foods daily:

1 pint milk
1 egg
1 serving meat, fish, or poultry
4 servings fruit — one to be citrus or tomato
4 servings vegetables other than potato — at least one to be raw and leafy
2 servings whole-grain cereal or bread
½ ounce butter
Other foods to provide adequate calories

Foods to avoid:

Highly refined and concentrated foods
Excessive amounts of very coarse cereals or bran
Fried foods
Excessive seasonings

TYPE DIET	SAMPLE MENU
Breakfast	
Raw or stewed fruit (fruit juice less desirable)	Stewed figs and raisins
Whole-grain cereal with milk and sugar	Rolled oats with milk and sugar
Egg	Scrambled egg
Whole-grain bread or rolls with butter and marmalade or jam	Wholewheat toast with butter and orange marmalade
Beverage	Coffee with cream and sugar
Luncheon or supper	
Cottage cheese, or substitute of meat, fish, or egg	
Potato, rice, macaroni, or noodles	Baked potato, with skin

TYPE DIET	SAMPLE MENU
Cooked vegetable	Creamed spinach
Salad with dressing	Pear and cottage cheese salad on lettuce with French dressing
Whole-grain bread with butter and jelly	Ry-Krisp with butter and grape jelly
Fruit	
Milk or buttermilk	Milk
Dinner	
Clear soup	Soup julienne
Meat, poultry, or fish	Lamb chop
Potato, white or sweet	Mashed potato
Vegetables, 2 servings	Buttered carrots
	Combination salad with Russian dressing
Whole-grain bread with butter	Graham rolls with butter
Fruit	Fruit cup — oranges, bananas, grapes
Beverage	Milk
Bedtime	
Fruit	Apple, raw

SPASTIC CONSTIPATION

Spastic constipation may occur as a separate disorder or as a complication of some other disease. Unlike the atonic type, spastic constipation is not a question of a deficiency of tone in the intestinal walls; in fact, the tonicity of the musculature is heightened. The contractions throughout the tract act in a spasmodic manner causing the movement of the food mass to be very irregular. Frequently the spasmodic movements cause acute pain.

Pathological Conditions. The muscle fibers of the intestinal walls are stimulated either by irritation of the intestinal mucosa or by extreme nervous susceptibility of the individual. Highly strung, nervous people are more frequently affected by this type of constipation than by the atonic type. The colon becomes spastic and the fecal mass may be more or less impacted at the point of spasticity. The stools are usually small, dry, ribbon-like, and frequently combined with mucus. Any substance which tends to irritate the colon will set up a series of contractions more or less painful in character.

Planning the Daily Diet. The purpose of the diet is to correct existing conditions (1) by removing chemical or mechanical irritation which may bring about the spasmodic contractions of the muscular walls, and (2) by providing enough bulk in smooth form to prevent stagnation of the food mass in the intestines, thus promoting its passage down the tract. The diet needs to be modified so that the cellulose is finely divided. Bland foods which will prevent chemical irritation of the tract are indicated.

SOFT MODERATELY HIGH CELLULOSE DIET

General rules:

The soft diet (page 247) is the basis for treatment but it should be supplemented with foods rich in minerals and vitamins.

The meals should be small in size and may need to be served in five or six meals.

Eight to 10 glasses of water are indicated daily in spastic constipation as well as atonic constipation.

Thermal stimulation as well as chemical and mechanical stimulation must be avoided. Excessive use of hot or very cold foods is contraindicated.

The most important single factor in treatment of spastic constipation is emphasis on good habits of personal hygiene, relaxation, and freedom from nervous upsets.

Brewer's yeast may be used as a supplement to this diet upon advice from the physician.

Include these foods daily:

1 pint milk
2 eggs or 1 egg and a substitute of cottage cheese, ground meat, fish, or poultry
1 serving meat, fish, or poultry—very tender or ground
3 servings butter
1 serving strained or refined cereal
2 or more servings strained cooked or canned fruit
1 serving citrus or tomato juice
2 or more servings strained cooked vegetables
Additional foods to provide adequate calories

Foods to avoid:

Coarse bread and cereals containing bran
Hot breads and muffins
Graham or whole-grain crackers
Desserts which contain whole fruits or nuts

Pastries, pies, rich cakes
All fried foods
Condiments, pickles, relishes

TYPE DIET	SAMPLE MENU
Breakfast	
Strained fruit, citrus juice, or ripe banana	Bananas
Strained or refined cereal with milk and sugar	Puffed rice with milk and sugar
Egg	Soft cooked egg
Enriched white bread with butter	Toast with butter
Beverage	Coffee — 1 cup only
Luncheon or supper	
Cream soup	Cream of pea soup
Egg or substitute of cottage cheese, ground meat, fish, or poultry	Baked salmon loaf
Potato, rice, noodles, spaghetti, or macaroni	Creamed potatoes
Strained vegetables	Strained carrots
White bread with butter	White bread with butter
Strained fruit, or plain pudding	Applesauce
Milk	Milk
Dinner	
Tomato juice or citrus juice	Tomato juice
Ground meat, fish, or poultry	Minced chicken
Potato without skin	Mashed potato
Strained vegetable	Strained green beans
White bread with butter	White bread with butter
Strained fruit, ice cream, or plain pudding	Butterscotch pudding
Milk	Milk

Note: For some individuals the smaller meals are desirable. The dessert and milk may conveniently be saved for between meal feedings.

INTESTINAL OBSTRUCTION

Intestinal obstruction will cause a delay in the movement of the feces. The dietary measures provide foods which will be practically free of residue and which will trickle past the obstruction, and furnish at least a small amount of nourishment. However, the diet is in no way curative, and it cannot be sufficiently adequate under the

circumstances. As a rule, the obstruction must be removed by surgical intervention before an adequate diet can be administered. The postoperative diet should be residue free for a period of time. The residue-free diet outlined on pages 358-9 is usually used.

SUMMARY

Diet is an important factor in atonic and spastic constipation. Placid unemotional individuals, especially those living a sedentary life with little exercise, are more prone to develop the atonic type of constipation, while highly nervous and neurotic individuals more often suffer from spastic constipation.

Atonic constipation is characterized by a decrease in the tone of the muscles of the intestinal walls especially of the colon. Peristalsis is impaired and the food is delayed in its passage down the tract. The causes are (1) too concentrated diet with too little water, (2) poor personal hygiene, (3) extensive use of laxatives over a long period of time, and (4) too little exercise. The purpose of the dietary treatment is to stimulate the movements throughout the tract, and to build up the tone in the walls of the intestines. This is accomplished by providing a normal diet which contains additional fruits and vegetables to supply increased cellulose, vitamins, and minerals; by increasing the fluid intake to 8 or 10 glasses daily; and by stressing regular habits of meal times, exercise, and elimination.

Spastic constipation is characterized by over tonicity of the musculature of the intestines, especially of the colon. The movements are spasmodic and the feces are propelled at irregular intervals down the tract. Spastic constipation may be caused by nervous instability, or by irritation produced by excessive use of coarse cereals, bran, or laxatives. The purpose of the diet for spastic constipation is to provide foods which will not irritate the mucosa of the intestines, and thus reduce the violence of the contractions; to help prevent the formation of dry, hard stools by increasing the fluid intake to 8 or more glasses daily; to furnish essential residue in a finely divided form which will not stimulate or irritate the sensitive walls of the intestinal tract.

PROJECTS

1. Plan a diet for a patient with chronic atonic constipation in which the cellulose, minerals, and vitamins are in larger amounts than required for the normal individual. Calculate the vitamin B_1 content of this diet.

2. Plan a diet for a patient with spastic constipation. Calculate the vitamin B_1 content of this diet.

REVIEW QUESTIONS

1. Define the term "constipation."

2. For which types of constipation is dietetic treatment advised?

3. Name the causes for the development of constipation. Which ones lead primarily to atonic constipation? Which ones to spastic constipation?

4. Differentiate between the symptoms of spastic and of atonic constipation.

5. What type of individual is likely to develop atonic constipation? Spastic constipation?

6. Name five foods especially valuable in the treatment of atonic constipation.

7. What are the differences between dietary treatment of the twc types of constipation?

CHAPTER XXVI

Diet in Disturbances of the Intestines—Diarrhea, Colitis, Celiac Disease

DIARRHEA

Diarrhea is an intestinal disturbance characterized by a morbid frequency in bowel evacuation, the stools usually being fluid in nature. It may be acute or chronic in character. Certain test diets (see Schmidt test diet, page 492) may be used to determine the exact nature of the disorder.

Diarrheas are classified as functional or organic. Kantor[1] has listed some of the functional diarrheas: the result of some irritant in the normal person; putrefactive or fermentative; allergic; nervous; a result of achlorhydria; associated with burns or uremia; endocrine imbalance, such as hyperactivity of the thyroid gland or lowered activity of the adrenal cortex. The organic diarrheas are those caused by bacteria as in bacillary dysentery, protozoa as in amebic dysentery, poisons, or certain unknown factors as in chronic ulcerative colitis.

Pathological Conditions. The acute irritation and inflammation of the intestinal tract which is present in diarrhea causes the food mass to be passed along more rapidly than under normal conditions. If the upper part of the small intestine is inflamed, the food passes so quickly down the tract that some of it may escape digestion and absorption, and fragments may be found in the stools; if the lower part of the intestines or the colon is the seat of the infection, undigested food is less likely to appear in the stools, but there may be an excessive amount of mucus or even blood present. There is a great loss of body fluids because of the number and consistency of the stools. A diarrhea which is chronic in character imposes a serious strain upon the entire body, causing a progressive emaciation and anemia. Efforts must be made to ascertain the cause of the

trouble and to overcome it as quickly as possible. The physician takes all these points into consideration when he gives his dietary orders.

Modifications of the Diet. When diarrhea is a symptom of some other disease, the original disturbance must be considered. The dietary treatment is directed toward elimination of all sources of irritation and stimulation, allowing the inflamed mucous lining of the intestines time to heal, and finally restoring the health and tone to the intestinal tract. To accomplish these objectives, the following modifications are made:

Residue. The diet progresses from foods leaving practically no residue to foods low in residue and then to those of smooth residue, bland in character.

Fluids. The intake of fluids is greatly increased to cover the loss of body fluids in the watery stools.

Choice of Nutrients. The proportion of the nutrients will depend in part on the type of diarrhea present. Protein foods are temporarily reduced to a minimum in putrefactive diarrheas, while carbohydrates are limited in the fermentative diarrheas. Fats are usually restricted in the diet until the stools become more nearly normal.

Nutritive Adequacy. The food intake is necessarily low at first, no attempt being made to cover the energy needs during the first stages of the disease. When the bowel movements become less frequent and the feces more formed, gradual additions are made until the normal energy requirements are eventually reached.

The minerals, especially calcium and iron, and the vitamins will have to be watched in diets free from milk, vegetables, and fruits. Such limited diets cannot be used over an extended period. It may be necessary to resort to the use of vitamin concentrates, which should be prescribed by the physician.

In all chronic diarrheas it is of the utmost importance to allow liberal intakes of protein, minerals, and vitamins since the decreased absorption from the intestine may otherwise result in nutritive failure.

Sequence and Administration of the Diet. In all cases of diarrhea the entire digestive tract requires a period of rest. This period of starvation lasts from 12 to 36 hours, according to the age of the patient and the severity of the condition. During this time nothing

is given by mouth except weak tea, fat-free broth, and water in abundance. In some cases it is necessary to resort to subcutaneous or intravenous feeding.

This starvation period is followed by the use of low-residue foods. Experimental work (Hosoi, Alvarez and Mann[2]) has indicated that scraped beef, veal, or chicken, hard cooked eggs, boiled and steamed rice, strained fruit juices, and broth leave little if any residue in the intestinal tract and furnish complete rest for the inflamed colon. The following diet is adapted from the residue-free diet used at the University of Michigan Hospital.[3]

RESIDUE FREE DIET

(For Gastro-intestinal Disorders)

General rules:

This diet is inadequate in minerals and vitamins, and should be used only for a limited time.

When the extreme symptoms have subsided, the diet outlined below may be liberalized to include dry white bread, all highly refined cereals, including spaghetti, noodles, and macaroni, and cottage cheese.

Foods allowed:

Beverages — carbonated beverages, coffee, coffee substitute, tea
Bread — arrowroot cookies, rice biscuits
Cereals — rice, rice products
Desserts — gelatin flavored with coffee, fruit juice, or carbonated beverage
Eggs — hard cooked
Fat — any fat not to exceed three tablespoons daily
Fruit — strained fruit juices
Meat, fowl, or fish — scraped beef, fowl, minced liver, oysters, sweetbreads, roast veal
Soup — clear broth flavored with strained vegetable liquor
Sweets — sugar, jelly, honey, syrup, candy in limited amounts
Seasoning — salt; others omitted or limited
Vegetable — tomato juice, strained vegetable liquor

Foods to avoid:

Coarse breads and cereals
Cheese
Rich desserts
Fat in excess of 3 tablespoons daily

Fried foods
Fruits except strained fruit juice
Tough meats
Spices, condiments, highly seasoned foods
Sugar and sweets in excess
Vegetables except strained vegetable juices

TYPE DIET

Breakfast

Strained fruit juice
Hard cooked egg
Arrowroot cookies
Coffee

Luncheon or supper

Broth, flavored with vegetable juice
Tender meat, fowl, egg, or oysters
Fruit juice gelatin
Rice biscuits
Tea

Dinner

Strained fruit juice
Tender meat, fowl, egg, or oysters
Buttered rice
Arrowroot cookies
Tea

BLAND LOW-CELLULOSE DIET

The third stage is marked by the use of a bland low-cellulose diet (page 334) which neither stimulates nor irritates the tract. The following modifications of this diet may be made: (1) three meals a day are usually sufficient although a six meal regimen as outlined may be advisable for some patients; (2) two glasses of milk are sufficient if the three meal regimen is used; (3) meat broths and meat extracts need not be as severely restricted as they are for the patient with ulcers; (4) black coffee may be allowed in reasonable amounts if the patient desires.

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit juice, strained fruit, or ripe banana	Applesauce
Strained whole-grain cereal or fine cereal	Rice Krispies with
	Milk and sugar
Milk and sugar	
Egg	Scrambled egg
Toast with butter	Rye toast with butter
Beverage	Coffee

BLAND LOW-CELLULOSE DIET (*Continued*)

TYPE DIET	SAMPLE MENU
Luncheon or supper	
Egg or substitute of mild, soft cheese, or tender meat, or fish	Creamed salmon on Buttered Melba toast
White potato (without skin), rice, noodles, spaghetti, or macaroni	Baked potato (no skin) with Butter
Fine-grain bread with butter	Enriched white bread with butter
Strained fruit	Strained peaches
Milk	Milk
Citrus juice	Orange juice — ½ glass
Dinner	
Tomato juice — ½ glass	Tomato juice — ½ glass
Tender meat, fish, or fowl	Roast lamb
White potato without skin	Creamed potatoes
Strained vegetable	Strained spinach
Fine-grain bread with butter	Enriched white bread with butter
Dessert	Apricot whip with custard sauce
Milk	Milk

COLITIS

Colitis is an inflammatory condition in which the whole or part of the large intestine is involved. Although the exact cause is frequently difficult to determine, nutritional deficiency, allergy, and psychological factors are important. There is a close correlation in many patients between the severity of the disease and nervous disorders.

Pathological Conditions. Colitis may be acute or chronic in character, with or without ulcerative lesions. Both colitis and ulcerative colitis are characterized by changes in the secretory and motor processes, mucus being secreted in abnormal amounts, and the movements in the tract becoming alternately spastic and atonic. The inflammation in the colon may be secondary to some other infection, or it may be a primary condition starting in the walls of the colon and gradually spreading to the membranes lining the organ. Alternating constipation and diarrhea are frequently characteristic. Mucus, pus, and blood often occur in the stools, and anemia is likely to develop as a result of poor iron absorption and retention. Other essential constituents of the diet, such as minerals and vitamins, are also likely to be lost. The symptoms of nutritive

deficiency appear sooner or later unless these conditions can be corrected.

Modifications of the Diet. The cause of the irritation must first be determined if successful treatment is to be instituted. The object of the diet is to supply nutrients which will reinstate normal nutrition and maintain it, and, at the same time, afford maximum rest to the colon to give it a chance to heal. Drastic measures must be taken during the acute stage; but such measures cannot be long continued in chronic ulcerative colitis because it is a stubborn condition and requires constant care and dietary supervision over an extended period of time. Dietary treatment must be accompanied by rest in bed and proper psychotherapy. It will be noted that the modifications of the diet are similar to those recommended for the treatment of diarrhea.

Consistency and Bulk. Foods must be soft and bland to prevent irritation. Low-cellulose diets are indicated in early stages of treatment to avoid distention of the colon.

Protein. The intake of protein should be liberal, that is, from 100 to 150 Gm. daily.

Minerals. It is frequently necessary for the physician to prescribe iron in addition to that contained in the diet.

Vitamins. Increased amounts of all of the vitamins are necessary to compensate for impaired absorption. The B complex is helpful in improving intestinal tone.

Planning the Daily Diet. The nature of the diet will be determined by the severity of the disease. In serious cases it is usually advisable to begin with the residue-free diet (page 358) and to make a gradual transition from it to the bland low-cellulose diet (page 334). This may be accomplished by adding small amounts of refined cereals and bread, potato, puréed fruits and vegetables from time to time to the residue-free diet. Factors which require special emphasis in the bland low-cellulose diet are indicated in the type diet listed below.

BLAND LOW CELLULOSE HIGH PROTEIN DIET
(For Ulcerative Colitis)

General rules:

This diet is the same as that outlined on page 334 but increased amounts of some of the nutrients, protein especially, are necessary.

Three meals with three intermediate feedings insure adequate food intake without undue distention at any one time.

Fats are poorly tolerated by some patients. Whenever this is found to be the case, only small quantities of highly emulsified fats as egg yolk and butterfat should be allowed.

Whenever the patient does not tolerate milk, it is essential that large amounts of meat, fish, chicken, and eggs be included.

Cooked whole vegetables of mild flavor and cooked whole fruits may be gradually introduced when the patient's condition warrants.

A liberal intake of fluids is urged — at least 6 to 8 glasses daily.

Thorough mastication of the food must be stressed.

Fatigue and emotional strain must be avoided.

Cathartics should not be used except upon advice of the physician. It is important to establish regular bowel habits.

In very severe cases the initial diet should follow the pattern of the residue-free diet on page 358.

TYPE DIET	SAMPLE MENU
Breakfast	
Strained fruit, fruit juice, or banana	Sliced bananas with milk
Fine-grain or strained cereal	Cream of Wheat with milk and sugar
Milk and sugar for cereal	
Egg — 1 to 2	Soft cooked egg
White toast with butter	Enriched white toast with butter
Beverage	Weak coffee with cream and sugar
Midmorning	
Milk	Milk — 1 glass
Luncheon or supper	
Strained cream soup	Strained cream of mushroom soup
Egg, cottage or cream cheese, tender meat, fish, or fowl — large serving	Beef patties — 2
Potato or substitute	Buttered noodles
White bread with butter	Enriched white bread with butter
Strained fruit or ripe banana	Strained apricots
Milk	Milk
Citrus juice	Grapefruit juice — ½ glass
Midafternoon	
Milk beverage	Eggnog
Dinner	
Tomato juice	Tomato juice — ½ glass

TYPE DIET	SAMPLE MENU
Tender meat, fish, or fowl — large serving	Breast of chicken
Potato without skin	Mashed potato
Strained vegetable	Strained carrots
White bread with butter	Enriched white bread with butter
Dessert	Tapioca cream
Milk	Milk
Evening nourishment	
White-bread sandwich with egg or soft cheese	Cream cheese sandwich with white bread
Milk beverage	Weak cocoa

MUCOUS COLITIS

Mucous colitis is believed to be a functional disturbance, or neurosis of the bowel. According to Henry[4] "there is an intimate relationship between the emotional disorders and digestive functions; the more intense the emotional disturbance or conflict the more the digestive processes are disordered. Persons who are intensely depressed or perplexed may retain food residue in the body for over two weeks." The condition in this disturbance is characterized by the presence of large quantities of mucus in the stool and by poor evacuation of the bowel. In severe cases the patient may suffer from colic, spastic constipation, and toxemia resulting from putrefactive processes.

The treatment of mucous colitis includes control of constipation, control of mucus accumulation, relief of colic, and general upbuilding of the health by proper dietary measures, rest, and psychotherapy. The constipation is of the spastic type and may be corrected by the use of the soft moderately high-cellulose diet (page 352).

CELIAC DISEASE

Celiac disease is a disturbance of the intestinal tract which occurs in young children beginning as early as six months of age but seen more frequently in children after the first year of life. It may occur up to the age of 10 years.

Metabolism and Pathological Conditions. Celiac disease is chronic in character and appears to result from the inability of the

body to tolerate fats and carbohydrate. The fats are digested but not absorbed, and the carbohydrates ferment and form gas, which in turn interferes with the assimilation of the fats. Mineral salts are also carried out of the body as a result of defective absorption processes. Characteristic symptoms occur in celiac disease as a result of the intolerance of fats and sugars; (1) a marked enlargement of the abdomen due to excessive fermentation of the carbohydrates in the intestines; (2) shrunken, flat buttocks; (3) loss of weight and retarded growth; (4) loss of muscle tone, especially of the chest; (5) impairment in the development of the bones because of the loss of calcium and phosphorus; (6) loss of appetite, vomiting, and the development of anemia; (7) irritability and fatigue resulting from the low sugar content of the blood; and (8) the occurrence of an excessive quantity of fats in the stools, frequently amounting to three times the quantity excreted by the normal child — stools are large and semi-fluid in character and have a grey color known to indicate the "soap stool."

It is important to distinguish between true celiac disease and congenital pancreatic deficiency, for the proper dietary treatment is dependent on this differentiation.

Modifications of the Diet. The diet for a patient with celiac disease is not an easy one to plan. These factors must be kept in mind:

Protein. The protein foods are almost always well tolerated, and the diet must necessarily be high in these foods. High-protein milk, skimmed milk reinforced with skimmed milk powder, cottage cheese, scraped beef, minced liver, veal, or lamb, chicken, fish, and egg white are among the best tolerated foods.

Carbohydrate. Because of the marked intolerance to carbohydrate it is necessary to curtail the intake to the lowest possible level. The sugars of the *well ripened* banana are utilized and banana as such, or banana powder, may be used as a source of calories. When improvement occurs other carbohydrate foods such as honey, dextrose, and Zwieback or Melba toast are added very gradually.

Fat. The inability to absorb fats necessitates a decided reduction in this nutrient. Even whole milk is not tolerated in the early stages. Any meats which are used must be very lean. Egg yolk is usually permitted early.

Energy. Because the fat and carbohydrate levels in the diet are so very low it is necessary to watch particularly the energy value of the diet if the child is to make any weight gain. The increased amounts of protein help to furnish calories, while bananas, banana powder, honey, and dextrose supply additional padding.

Minerals. It is frequently necessary to reinforce the diet with calcium and iron to avoid defective bone formation and anemia.

Vitamins. The altered diet itself together with the interference with normal absorption result in inadequate vitamin supply. It is always necessary to reinforce the diet with vitamin concentrates since deficiency diseases are otherwise likely complications.

Consistency. The impaired efficiency of the digestive system requires that meats be finely divided or ground, and that fruits and vegetables, when given, be cooked and puréed. Ripe bananas and orange juice are the only raw fruits allowed.

Sequence and Administration of the Diet. The most successful regimens for celiac disease have included those in which the diet has progressed from one stage to another as improvement occurs in the child's condition. The diet should be advanced only as there is general improvement in the child's weight, appetite, and condition of the stools. No set time can be given for the duration of each stage, and the time indicated below is merely suggestive.

THREE STAGE DIET FOR CELIAC DISEASE

(Adapted from Hess[5])

FIRST STAGE — one to three weeks

General rules:

Four feedings of the protein milk are given daily — 7 and 10 A.M., 2 and 6 P.M. If there is marked anorexia, feedings may be divided into six portions.

Water should be given between feedings to total a quart or more of fluids in 24 hours.

Vitamin concentrates should be provided.

Composition of the formula:

1 tablespoon* powdered protein milk for each pound of body weight

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*The total daily amount of powdered protein milk is increased by 2 tablespoons every 5 to 7 days until the number of tablespoons approximates the child's best previous weight. For example, if the child weighed 24 pounds before his illness, the formula should be increased until it contains 24 tablespoons dry protein milk.

2 to 3 ounces Ringer's solution or boiled water for each pound of body weight

¼ to 1 grain saccharin

Cocoa or vanilla flavoring, if desired

Rub powder to paste with small amount of liquid. Gradually add remainder of liquid. Strain if necessary. Heat to body temperature before serving. Avoid overheating.

SECOND STAGE — two to four weeks

General rules:

The protein milk feedings are continued at the usual intervals.

Small but increasing quantities of the foods listed below are added at the 10 A.M. and 6 P.M. feedings.

Vitamin concentrates must be provided.

Foods allowed:

Protein milk

Powdered skim milk may be substituted gradually for the protein milk

Scraped beef

Cottage cheese made from skimmed milk

Egg

Orange juice

THIRD STAGE — a year or longer

Foods allowed:

Protein milk, lactic acid milk, and small amounts of boiled whole milk. The boiled whole milk is gradually substituted for part of the protein milk after two months of successful treatment.

Eggs — 2 whole

Cottage cheese

Scraped beef, minced liver, lamb, veal, chicken, or fish

Orange juice

Ripe banana — beginning with ½ daily up to as many as a dozen

Gelatin sweetened with dextrose (cerelose)

Well cooked puréed vegetables, after the fourth month

Dextrose (cerelose)

Corn syrup, well cooked cereals as rice, farina, arrowroot, cornflakes, puffed cereals, Melba toast, zwieback — usually not tolerated until three months of successful treatment have passed.

Foods to avoid:

Starches and sugars as in bread, potatoes, ice cream, cake, cookies; they may be given after a year or more of treatment.

Fats of any kind

Raw fruits and vegetables

VITAMIN AND MINERAL REINFORCEMENTS TO BE USED AT ALL STAGES

Vitamins A and D — viosterol in halibut-liver oil — 30 drops daily
Ascorbic acid — 50 mg. daily, or orange or tomato juice to supply equivalent amounts
Brewer's yeast — 1 tablespoon daily
Liver extract has been recommended by some physicians.
Iron — ferric ammonium citrate as prescribed by the physician

SAMPLE MENU FOR THIRD STAGE—CHILD, 3 YEARS OLD

Breakfast

Orange juice — ½ to 1 orange
Egg, soft boiled — 1
Cottage cheese — ½ cup
Banana, ripe — 1
Protein milk — 8 ounces

Dinner

Scraped beef patty — 1
or
Minced chicken — ½ cup
Protein milk — 8 ounces
Gelatin dessert — ½ cup

Supper or Luncheon

Egg, soft or hard boiled — 1
or
Meat as allowed from list
Cottage cheese — ½ cup
Banana — 1
Gelatin dessert — ½ cup
Protein milk — 8 ounces

Other diets for the treatment of celiac disease have met with equally good, if not better, success. The late Dr. Marriott[6] allowed a more liberal diet in the initial stage. Additions were made from time to time in much the same manner as outlined above; that is, well cooked and strained vegetables were allowed in small amounts after improvement was certain on the more restricted regimen. Whole eggs were allowed instead of the egg whites, and whole milk was gradually substituted for the skimmed milk. After another four or five months small quantities of well toasted bread or zwieback were usually tolerated, as were also the well cooked cereals as cornflakes, grapenuts, puffed wheat, or rice.

FIRST STAGE

Foods allowed: Amounts needed for a child of two to three years
Boiled skimmed milk or fat-free buttermilk — 24-32 ounces
Cottage cheese from milk skimmed free from fat — 1 ounce
Egg whites, coddled — 2 to 3
Sieved, boiled liver — 1 to 1½ ounces
Baked ripe bananas — 1 or 2

Strained orange juice — 8 ounces
Strained tomato juice — 8 ounces
10 per cent dextrose solution — 4 to 6 ounces hourly between meals; orange juice may be used for flavoring

Number of feedings—four daily

SECOND STAGE

Foods allowed:

Substitutes for skimmed milk or buttermilk
- Boiled whole milk
- Whole lactic-acid milk
- Equal parts evaporated milk and water

Eggs — 2 whole
Well cooked and strained vegetables in small amounts, gradually increasing the daily intake
All foods listed for stage I

THIRD STAGE

Foods allowed:

Well toasted bread or zwieback
Well cooked cereals as cornflakes, puffed wheat, grapenuts, or rice
All foods listed for stages I and II

SUMMARY

Diarrhea may be acute or chronic, functional or organic. The causes are many, but all types are characterized by frequent and watery stools. The disturbance leads to great loss of body fluids, inadequate absorption of foods, and ultimate nutritive failure if the disease is protracted.

The dietary treatment will depend somewhat on the type of diarrhea present, for a putrefactive diarrhea is best treated by a high carbohydrate, restricted-protein diet, while the fermentative diarrheas respond better to high-protein, low-carbohydrate diets. The chief characteristics of the diet for treatment of diarrhea, in general, are: (1) high fluid content; (2) liberal allowances of all of the nutrients, especially protein, in chronic disorders; (3) bland low cellulose foods which will prevent mechanical or chemical stimulation. The dietary treatment consists of three stages; a starvation period for 12 to 36 hours, allowing only tea, broth, and water; a

residue-free diet; and a bland low-cellulose diet. The transition from one stage to the next is made gradually until the patient is finally able to tolerate a normal diet.

Colitis is an inflammation of the colon. It may be acute or chronic, simple or ulcerative. The movements in the tract may be alternately spastic and atonic, and the patient suffers at times from constipation, and then again from diarrhea. Mucus, pus, and blood occur in the stools. Absorption of foods may be poor so that malnutrition results; anemia is a particularly common finding.

The dietary treatment for colitis and ulcerative colitis is like that for the diarrheas, but it is important that the patient does not remain on the residue free diet for long intervals since dietary deficiency may complicate the recovery. It is urged that the physician prescribe additional vitamin concentrates even when the bland low cellulose diet is used.

Mucous colitis is believed to be a functional disturbance of neurotic origin. Adequate treatment includes emphasis on psychological factors as well as rest and a diet designed to correct the constipation which is usually of the spastic type. The soft moderately high cellulose diet is suitable.

Celiac disease occurs in young children between 6 months and 10 years of age. There is an inability to digest carbohydrates and to absorb fats, and typical signs of severe malnutrition occur if the diet is not adjusted to the child's ability to use it. High-protein milk, skimmed milk, tender meats, cottage cheese made from skimmed milk, egg whites, orange juice, and bananas are the chief constituents of the early dietary stages. When improvement occurs, small amounts of well cooked and strained vegetables are added. It may be many months before even small amounts of Melba toast or zwieback are tolerated, although there is considerable variation in the patient's response. Each child should be considered individually, and foods added slowly to the diet as the child shows his tolerance for them. The protein foods are usually tolerated well, but the diet must be kept very low in fat, while carbohydrates in the more concentrated forms are added cautiously after many months — and sometimes years — of treatment. Vitamins must be given in concentrate form since the diet itself will not supply enough.

PROJECTS

1. Plan a day's menu for a patient with chronic ulcerative colitis. Allow at least 100 Gm. of protein, and adequate quantities of all other nutrients.

2. Calculate an adequate high-protein milk formula for a child with celiac disease whose best weight is 28 pounds, but who now weighs 19 pounds. About how long would it take to reach the desired concentration? Use the method outlined on page 365 for your calculations.

REVIEW QUESTIONS

1. What are some of the causes of diarrhea?

2. Name five ways in which the diet for a patient with diarrhea might be modified from the normal. Give the reasons for each modification.

3. What are the customary stages of dietary treatment for acute diarrheas? What modifications, if any, would be made for chronic diarrhea?

4. What foods are allowed in the residue free diet? Evaluate the adequacy of this diet.

5. What is colitis? What are some of the causes?

6. Why are dietary deficiency diseases frequent sequels to colitis? How may they be avoided?

7. Name the important modifications of the normal diet for a patient with ulcerative colitis, and give the reason for each.

8. What diet is recommended for the treatment of mucous colitis? Why?

9. What is celiac disease? What are some of the characteristic symptoms?

10. What metabolic disorders are present in celiac disease?

11. Enumerate the chief characteristics of the diet for celiac disease and list the foods which are best tolerated, and those which are least well tolerated.

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CHAPTER XXVII

Diet in Disturbances of the Liver and Gallbladder

The liver is the largest and one of the most important of all the organs of the body, because the absorption and utilization of the major portion of the foods entering the body depend upon it for their preparation and distribution. In fact, there is no organ which is concerned in so many of the body's functions nor upon which health depends more completely.

Functions of the Liver. A brief review of the normal liver and its various functions will serve to emphasize the importance of keeping it in good repair, of safeguarding it against overwork, and of protecting it against such abuses as will minimize its efficiency and bring about a state of disease. The liver, first of all, plays an essential role in digestion, for it secretes bile more or less continuously, the amount being greater when fat and protein foods are being digested. The bile salts are necessary for the absorption of fats and of the fat-soluble vitamins. Bile pigments which represent the waste from worn-out red blood cells are eliminated in the intestine by means of the flow of bile. Bile salts also make possible the utilization of vitamin K and retard intestinal putrefaction.

The liver is the body's most effective and versatile storehouse, filter, and dispatcher of food materials. When the various simple sugars reach the liver from the portal circulation they are converted to glucose for immediate use or they are manufactured into glycogen as such. Mann[1] states that the liver glycogen content may reach as much as 20 per cent following forced feeding of carbohydrate. By means of a very complicated mechanism in which the entire endocrine system plays an important role, the liver reconverts glycogen to glucose so as to maintain a constant level of glucose in the blood. Equally important is the function of the liver in the

metabolism of amino acids. Proteins can be stored here in appreciable quantities, and are readily released for emergency use. Any amino acids which are to be used for fuel are first deaminized by the liver, the ammonia being converted into urea. Another vital function of this organ is related to its ability to synthesize plasma proteins.

The exact part which the liver plays in fat metabolism is not entirely understood. No doubt some mechanism exists for rendering fats available for use by the body. Large quantities of fat may be stored in the hepatic tissue if the fat content of the diet is high, or if certain pathological conditions are present.

The study of the relation of vitamins to the liver has been most interesting. It is now known that vitamin K must be activated by the liver before it can be of value in the production of prothrombin. The body's store of vitamin A is kept here and the precursor carotene is converted to the active vitamin A.

As a conserver of body materials the liver is almost unique. It is here that the worn-out red blood cells are broken down so that the precious iron can be used over again and the remaining part of the red blood cells can be converted into bile pigments for excretion. Relatively large stores of iron exist in the liver. The antianemia principle necessary for the maturation of the red blood cells is also stored in the liver.

Detoxication is effectively brought about on substances which are toxic because of bacterial action, parasitic infections, or drugs.

Pathological Conditions. Disturbances of the liver and gallbladder include (1) acute hepatic congestion, (2) jaundice, (3) cirrhosis of the liver, and (4) cholecystitis. These disorders may be further complicated by overweight or constipation which must be taken into consideration when planning the diet.

General Dietary Modifications. The object of the dietary treatment of liver and gallbladder disturbances is to reduce the burden of the overworked liver, to avoid further injury, and to aid in regeneration of liver tissue.

Protein. It was formerly believed that a low dietary level of protein was desirable since it would obviate the necessity for much hepatic activity. However, an adequate intake of protein is probably

of greater importance than that of any of the other food constituents since it is essential for the maintenance and repair of the liver tissue itself. It is furthermore impossible to manufacture serum proteins without adequate material. Good diet therapy now emphasizes the inclusion of sufficient protein to maintain normal body processes, with additional building foods being provided whenever blood proteins are low. On the other hand, excessive intake is undesirable for that entails unnecessary hepatic activity in deaminization of the amino acids.

Mann[1] reports that extractives of meat may provoke ascites, and that the use of milk and egg proteins is to be preferred. Usually an intake of 1 to 1½ Gm. of protein per kilogram of body weight, or 70 to 100 Gm. daily, will prove to be a satisfactory allowance.

Carbohydrate. The value of carbohydrates in the maintenance of hepatic function, and in the protection of the liver against injury by anesthesia, drugs, and foreign agents has long been recognized. This is due to the large reserve of glycogen which is effected when liberal quantities of carbohydrate are fed. In diseases of the liver an intake of 300 to 500 Gm. of carbohydrate daily should be encouraged.

Fat. There is definite evidence that accumulation of fat in the liver decreases the capacity of this organ to perform its functions. The absorption of fat from the intestine is incomplete if there is interference with the flow of bile. Most diets should contain minimal quantities of fats, allowing only those which are highly emulsified and which are carriers of the fat soluble vitamins.

Vitamins. Since the diseased liver may not be able to convert carotene to vitamin A, it is important that appreciable amounts of vitamin A as such be given daily. Whenever evidence exists that absorption of vitamins is incomplete, it may be necessary to administer bile salts daily.

Consistency. Many patients complain of loss of appetite, nausea, vomiting, and distention. A soft diet with frequent small feedings should be recommended for such individuals.

Dietary Considerations in Specific Diseases. Successful planning of diets for liver diseases requires that one be familiar with some of the characteristics of the more common hepatic disorders.

Acute Hepatic Congestion. The dietary management of hepatic congestion is directed toward eliminating the stagnant material which is clogging the bowels and which has been subjected to the activities of putrefactive bacteria. Because the flow of bile has been interrupted, the fat intake must be very limited. The preliminary stage of dietary treatment is a starvation period while the attack lasts and until the intestines are emptied. Following the acute stage, soft easily digested foods such as soups, eggs, toast, cereal, and stewed fruits may be allowed. Individuals showing a tendency to biliousness should abstain from overeating, especially rich foods and concentrated sweets, should take plenty of exercise, and drink plenty of water. The diet should be regulated to prevent constipation.

Jaundice. When the flow of bile is obstructed in any way, the bile eventually gets into the blood and produces a condition of jaundice. This reabsorption of bile gives rise to the recognized symptoms of the disease — the yellow pigmentation of the skin and eyes, darkened urine, etc. Obstruction of the bile duct, however, is not the only cause of jaundice. The condition may occur when there has been abnormal destruction of the blood cells such as occurs in yellow fever, pernicious anemia, etc. The liver in such conditions is not able to dispose of the bile pigments with sufficient rapidity to prevent the accumulation in the blood, so the coloring of the skin, etc., naturally follows. In jaundice there is a marked disturbance of fat digestion, absorption in general is impaired because of the lack of bile in the intestinal juice, and the normal functions of the liver are upset. The condition may be mild or severe in character, the extent of the disturbance being indicated by the severity of the gastro-intestinal, kidney, and blood conditions.

The dietetic treatment of jaundice is directed toward removing the cause of the obstruction, toward stimulating the flow of bile into the intestine, and toward lessening the burden of the liver. The diet should be low in fat, adequate in protein, and comparatively high in carbohydrate. If the condition is severe a period of rest is instituted as the initial step, no food being given by mouth for 24 to 48 hours. A full fluid diet low in fat, and then a soft low fat high carbohydrate diet may be used.

Cirrhosis. One of the most serious problems in cirrhosis of the

liver is the hypoproteinemia and the ascites which usually accompanies the low serum proteins. There is, in addition, a tendency to hemorrhage and subsequent anemia. Adequate proteins are of utmost importance for the satisfactory control of the hypoproteinemia and of the edema. Daily intakes of 100 to 150 Gm. of protein should be encouraged.

The utilization of carbohydrates and the secretion of bile are also interfered with so that appropriate modification must be made for these factors as well. Carbohydrates should be given in liberal quantities since they spare protein and protect the liver against further damage. Again, the intake of fat should be limited.

Many patients with cirrhosis of the liver may be profoundly undernourished as a result of inadequate food intake for long periods of time. The accompanying anorexia and digestive disturbances require that one use great ingenuity in planning attractive and easily digested meals. An abundant intake of vitamins A and K, together with those of the B complex is helpful. Vitamin A should be supplied chiefly from animal foods.

Gallbladder Disease. The gallbladder is the storehouse for the bile. When diseased this organ may become inflamed (cholecystitis), or gallstones may be formed (cholelithiasis). One of the distressing symptoms in gallbladder disease is the contraction of the organ resulting in reflex gastric spasm. Substances such as fats, and to a lesser degree proteins, may contribute to these contractions since their digestion releases a hormone, cholecystikimin, which in turn is responsible for the contraction of the organ.[2]

When the gallbladder is unduly sluggish Aaron advocates the use of a high fat diet in order to stimulate normal release of the flow of bile, and to avoid concentration of bile and subsequent stone formation.

The diet should then be low or high in fats as dictated by the particular condition present, and adequate in proteins. Sufficient calories should be included for maintenance of normal weight, but overweight persons should be encouraged to lose weight. It is important to avoid constipation, and to include only foods which are easily digested and low in residue of a tough, fibrous character.

Planning the Daily Diet. The following low-fat, high-carbohydrate diet has been found to be of value.

MODERATELY LOW FAT HIGH CARBOHYDRATE DIET[3]

General rules:

Whenever gastro-intestinal disturbances are severe, a soft diet should be planned.

If less than 25 grams of fat are desired, one may substitute skim milk for whole milk and omit all the butter. Whenever the diet is limited in this fashion it is necessary for the physician to prescribe vitamin A concentrates.

The protein content of the diet may be materially increased by using skim milk to which egg white has been added.

Include these foods daily:

2 glasses milk — no more; additional skim milk may be used

2 servings (3-6 ounces) lean meat, fish, fowl, or pot cheese

1 egg — no more

3 teaspoons butter or fortified margarine — no more

2-4 servings whole-grain cereal or whole-grain bread

2-4 servings fruit — preferably one to be orange, grapefruit, or tomato

2-3 servings vegetables — in addition to one or more servings potato, corn, or dried beans; one vegetable to be uncooked

High carbohydrate foods such as bread, cereal, hard candy, jelly, potato, sugar should be emphasized

Foods to avoid:

Beverages and soups made with cream, butter, or whole milk (except that allowed on diet)

Berries and melons

Cream, sweet or sour

Cheese, except pot or cottage cheese

Chocolate (cocoa may be used)

Rich desserts as pastry, puddings, butter cakes, ice cream

Fried food

Sauces and gravies

Salad dressings including mineral oil dressing

Nuts

Strongly flavored vegetables as cabbage, broccoli, cauliflower, Brussels sprouts, onion, turnip, radish, cucumber, green pepper

Dried peas and beans

Spices and condiments in excess

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit, except melon or berries	Stewed apricots
Cereal with milk and sugar	Shredded wheat with Milk and sugar
Egg — only one	Scrambled egg
Wholewheat toast or rolls — 2 servings with 1 teaspoon butter	Wholewheat toast — 2 slices; Butter — 1 teaspoon
Marmalade or jelly	Marmalade
Beverage	Coffee with milk and sugar
Midmorning	
High carbohydrate fruit juice	Glucose lemonade
Luncheon or supper	
Cottage cheese or a substitute of lean meat or fish	Broiled whitefish
Potato, rice, noodles, spaghetti, macaroni or vegetable without fat	Fresh spinach
Salad with lemon or vinegar	Celery and carrot strips
Whole-grain bread with 1 teaspoon butter	Wholewheat bread — 2 slices; Butter — 1 teaspoon; Grape jelly
Fruit	Baked apple
Milk — 1 glass only	Milk
Midafternoon	
High carbohydrate fruit juice, bread or crackers, and jelly	Grape juice and gingerale; Crackers and jelly
Dinner	
Lean meat, fish, or fowl	Roast beef
Potato, without fat	Boiled potato
Vegetable, without fat	Green beans
Whole-grain bread — 2 slices with 1 teaspoon butter and jelly	Wholewheat bread with 1 teaspoon butter; Apple jelly
Fruit, gelatin, or low fat dessert	Raspberry ice
Milk — 1 glass	Milk
Evening nourishment	
Skim milk, crackers and jelly	Bread and jelly sandwich; Skim milk

When the patient is acutely ill and is unable to tolerate a regular or a soft diet, it will be necessary to use a full fluid diet (see page

246). Whole milk, however, is restricted to two, or sometimes three, cups daily, although skim milk may be used in liberal amounts.

SUMMARY

1. The liver has numerous functions the more important of which are:
    a. Secretion of bile which is necessary for absorption of fats and the fat-soluble vitamins
    b. Storehouse for glycogen, amino acids, iron, vitamins A and K, the anti-anemia principle
    c. Manufacture of plasma proteins
    d. Deaminization of amino acids and conversion of waste nitrogen into urea
    e. Maintenance of constant blood sugar value by means of releasing glucose from the glycogen stores
    f. Detoxication of chemical and bacterial poisons.
2. General dietary modifications in diseases of the liver and gall-bladder require that:
    a. Protein should be adequate and of the best quality for replacement of liver tissue and maintenance of normal serum proteins
    b. Carbohydrate must be liberal to effect storage of glycogen thus minimizing further liver damage, as well as sparing protein
    c. Fats must be kept at a minimum compatible with a normal intake of vitamins
    d. Vitamin A should be given as such rather than as the precursor carotene since the diseased liver may not be able to make the conversion to the active form
    e. Bile salts may need to be given if vitamins A and K are to be absorbed
    f. Soft easily digested foods are recommended. Strongly flavored vegetables, and tough, fibrous residues may be irritating.

PROJECT

1. Plan a low fat high protein diet for a patient who has cirrhosis of the liver. Calculate the protein and fat content. Calculate the amount of vitamin A which is derived from animal sources.

REVIEW QUESTIONS

1. Discuss in detail the functions of the liver in digestion, metabolism, storage, manufacture, regulation, and detoxication.

2. What are three functions of bile?

3. Of what importance is the gallbladder?

4. Under what circumstances would you use a high fat diet in gallbladder disease? When would you use a low fat diet?

5. What reasons can you give for the use of a high-carbohydrate, high-protein, moderately low-fat diet in liver diseases?

6. What is the difference between a strict low-fat and a moderately low-fat diet? Are both diets equally adequate?

7. Why are these foods contraindicated for patients with gallbladder disease: strongly flavored vegetables, berries, highly seasoned foods, melons.

8. What dietary precautions might one take to minimize the occurrence of liver and gallbladder disease?

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CHAPTER XXVIII

Diet in Diabetes Mellitus

Diabetes mellitus is a disease of metabolism, the outstanding characteristic of which is the lessened ability, or the complete inability, of the tissues to utilize sugars. This is due to the fact that the hormone insulin, which is essential for the oxidation and storage of sugar, is present in quantities too small to meet the needs of the body. Insulin is a secretion manufactured by the cells of the Islands of Langerhans in the pancreas, and is entirely different from the digestive juices which are secreted by another group of cells in the same organ. Insulin is released into the blood stream to be used for the conversion of glucose to glycogen in the liver and for the later release of glucose as needed by the tissues. When insufficient insulin is secreted the sugar cannot be utilized and accumulates in the blood until at a certain point it spills over into the urine.

Fatty acids are oxidized completely in the normal body irrespective of the simultaneous presence or absence of carbohydrate. However, there is an upper limit to such oxidation. In diabetes, the failure to supply sufficient energy from carbohydrate leads to an increased destruction of fat and protein in an attempt to provide the necessary fuel. This excessive breakdown of fat and protein leads to the production of fatty acids beyond the ability of the tissues to completely oxidize them. Eventually an accumulation of these lower fatty acids or ketones (acetone, acetoacetic acid, and beta hydroxybutyric acid) occurs in the blood and they are excreted in the urine together with fixed base. The depletion of body base leads ultimately to acidosis. It is seen that the altered carbohydrate metabolism in turn influences all the chemical changes which take place in the body.

It has been found that other organs than the pancreas are also concerned in the development of diabetes. The liver, and the pituitary, thyroid, and adrenal glands are all related to the functioning

of the pancreas and the sympathetic nervous system is undoubtedly concerned. In other words, the endocrine system maintains a delicate balance of carbohydrate metabolism, and disaster results if the function of any one of these glands is disturbed.

Predisposing Factors. Heredity and obesity are the most important predisposing factors in the development of diabetes. A predisposition to diabetes is inherited as a mendelian recessive character; that is, if two diabetic persons marry, all of their children are potential diabetics. If a diabetic marries a diabetic carrier, half of the children will be potential diabetics, and so on.

The percentage of obese individuals showing diabetes is far greater than that of individuals who are of normal weight or slightly underweight. Approximately 80 per cent of the adults in Joslin's diabetic clinic had previously been overweight by 5 per cent or more. On the contrary, children and adolescents have been more commonly underweight than overweight.

The disease is more prevalent among mental workers than manual laborers, and is more frequent among people who have a bountiful supply of food and plenty of leisure. The Jewish people have been subject to diabetes more often than other racial groups.

Many cases of diabetes are preventable. The individual who has diabetic relatives should be urged to avoid overeating, especially of concentrated carbohydrate foods.

Pathological Conditions. The disturbed metabolism in diabetes brings about the following characteristic symptoms of the disease:

Polyuria. Glucose is a recognized diuretic; and when it passes through the kidneys in excessive amounts, the increased stimulation results in an abnormally large outflow of urine.

Polydipsia. The great loss of body fluids in the urine explains polydipsia, or excessive thirst.

Polyphagia. Every gram of glucose lost in the urine and every gram of nonutilized glucose (or fat) in the blood represent so much lost nourishment; hence polyphagia, or an increased appetite results.

Loss of Weight and General Weakness. When the body cannot utilize the food eaten to carry on its work, it will call upon its own tissues to carry on the processes. This breakdown of the tissues leads to general weakness and loss of weight.

The diagnosis of diabetes is based on these symptoms plus the

results of laboratory tests on the urine and blood (pages 488-9). The occurrence of sugar in the urine should be regarded as evidence of diabetes until proven otherwise. Occasionally, sugar in the urine is due to causes other than diabetes; for example, pentosuria is the result of the body's failure to use pentose; lactosuria may occur in nursing mothers; and renal glycosuria may result from the lowering of the renal threshold for sugar. If sugar is present in the urine, one should also test for diacetic acid to determine whether there is an excess of incompletely oxidized fatty acids in the blood.

The glucose-tolerance test (page 489) is valuable in the diagnosis of diabetes. It is a measure of the ability of the body to utilize a known amount of glucose. A normal individual shows a rise in blood sugar about one half hour after ingestion of the sugar, but the blood sugar value returns to the normal level in 2 hours. In the diabetic, however, the tissues are unable to utilize the sugar because of lack of sufficient insulin, and the blood sugar remains elevated.

Metabolism in Diabetes. The basal metabolic rate in diabetes is essentially normal, except in those severe, uncontrolled patients who may have become extremely malnourished because of their inability to utilize glucose. In the latter group one may find a reduction of the basal metabolic rate by as much as 30 per cent.

Carbohydrate Metabolism. The blood normally maintains a glucose concentration of 0.08 to 0.12 per cent, or 80 to 120 mg. glucose per 100 cc., but if carbohydrate cannot be utilized in the tissues the concentration in the blood increases. If the blood sugar content reaches 0.14 per cent there is reason to suspect diabetes. Sugar begins to spill over into the urine when the renal threshold is reached. This point varies in different individuals but is approximately at 0.17 per cent. In severe diabetes the fasting blood sugar may be as high as 0.2 to 0.4 per cent, and occasionally higher.

The glucose in the body can originate from three nutrients; namely, carbohydrate, protein, and fat. All of the carbohydrate in a given diet will supply available glucose. After the amino acids have been deaminized, the remaining part of the molecule may be oxidized partly to glucose and partly to fatty acids. About 58 per cent of the amino acids, or protein, will be oxidized to glucose. The glycerol fraction of the fat molecule, or about 10 per cent of the total fat, can also be converted to available glucose. If the diet is

insufficient, and body tissues are being burned, available glucose is also derived from the combustion of body protein and fat in the same ratio as that for dietary protein and fat respectively.

Fat Metabolism. When the carbohydrate metabolism becomes disturbed and the capacity for utilizing glucose is reduced, the metabolism of the fats is also disturbed. The entire role of carbohydrate in the oxidation and utilization of fat is not understood. However, the theory that "fats burn in the fire of carbohydrates" no longer is tenable. It is now known that simultaneous oxidation of carbohydrate is not necessary for the complete combustion of fats. In diabetes the poor utilization of carbohydrate results in such a rapid breakdown of fat that the body cannot oxidize all of the fatty acids formed. The ketones produced in excess of the body's ability to oxidize them accumulate in the blood and are excreted in the urine.

The fatty acids are derived from the food and body fats and also from food or body proteins. About 90 per cent of the fat molecule yields fatty acid, while approximately 46 per cent of the protein molecule yields fatty acids. Foods are sometimes classified as ketogenic or antiketogenic depending upon the preponderance of fatty acid or glucose in them. Fats are ketogenic, meats and eggs are approximately neutral, while fruits and vegetables are antiketogenic.

Modifications of the Diet. The objectives in the dietary treatment of diabetes are several: (1) to provide adequate nutrition; (2) to correct the faulty metabolism of sugar and fat by eliminating sugar from the urine, reducing the blood sugar to normal, and avoiding ketosis; (3) to improve the ability of the body to utilize glucose; and (4) to avoid complications such as arteriosclerosis, and infections. Sansum[1] states that more than 50 per cent of all diabetics require nothing more than dietary adjustment to the limited supply of insulin produced by the body, while an additional number need insulin only at the beginning of treatment. For others, additional insulin is continuously necessary so that an adequate diet can be metabolized.

The diabetic patient must observe dietary restriction for the remainder of his life. Such regulation when properly made permits the patient to lead an essentially normal life. However, great care must be taken that this diet always provides the elements of good

nutrition. Each diabetic diet is specific for the individual concerned.

Protein. It is well recognized that the stimulation to the metabolism which is occasioned by consuming excessive quantities of protein should be avoided. About 1 to 1½ Gm. of protein per kilogram (½ to ⅔ Gm. per pound) of ideal body weight is a satisfactory allowance for protein. The daily intake should not exceed this very greatly except where growth or certain pathological conditions may require it.

Energy. It is desirable to maintain metabolism about 5 to 10 per cent below the normal in the diabetic individual since the utilization of glucose appears to be improved. However, appreciable loss of weight must be avoided, nor must the patient lose his sense of well being. The following allowances for calories based on normal body weight are used by Pennock[2] and his associates at the Walter Reed General Hospital:

	Calories per kilogram	Calories per pound
For a bed patient	25	11.5
For light work	30	13.5
For medium work	35	16
For heavy work	40	18

These levels can be increased or decreased as necessary to maintain the optimum weight.

Every effort should be made to reduce the obese individual to expected weight for his height and age. Such weight loss in middle-aged, obese, diabetic patients very commonly leads to a return to normal glucose tolerance according to Newburgh.[3]

Carbohydrate. The distribution of the non-protein calories between carbohydrate and fat is a much discussed subject. Dr. Joslin[4] of Boston considers 100 Gm. of carbohydrate to be the daily minimum allowance for an adult patient over an extended period. He advises, as a rule, from 140 to 150 Gm. daily and considers 200 Gm. the upper limit. Sansum, on the other hand, advocates a high carbohydrate intake and gives twice as much carbohydrate as fat. Newburgh bases the carbohydrate allowance on the total glucose intake rather than on the carbohydrate as such, and allows approximately 150 Gm. of available glucose daily. In some mild cases the

urine may be kept sugar free without the use of insulin by markedly limiting the carbohydrate allowance, but in general not less than 100 Gm. of carbohydrate should be included daily. Forty to 60 per cent of the non-protein calories may be derived from carbohydrate while fat supplies the remainder of the diet.

Calculation of the Diabetic Diet Prescription. The diabetic diet is individualized for each patient and so planned that it is physiologically correct. The physician calculates the prescription basing his allowances on:

1. The history of both the patient and his family
2. Sex, age, weight, height, and activity of the patient
3. Type of diabetes — mild or severe
4. Type of insulin, amount, and when administered
5. Nutritional requirements as based on the above data

An illustration is here given of the manner in which a diabetic prescription may be calculated. Let us assume that a diet is to be planned for a secretary who is 25 years old and 63 inches tall. According to the table of heights and weights in the Appendix (page 735) her ideal weight is 128 pounds.

(1) *Calories:* 13.5 calories per pound of ideal body weight
$128 \times 13.5 = 1728$ calories per day
(2) *Protein:* 0.5 to 0.67 Gm. per pound of ideal body weight
$128 \times 0.6 = 77$ Gm. protein per day
(3) *Non-protein calories:* $1728 - 308 = 1420$ calories to be divided between carbohydrate and fat
(4) *Carbohydrate:* 40 to 60 per cent of non-protein calories
50 per cent of 1420 calories = 710 calories
$710 \div 4 = 177.5$ Gm. carbohydrate per day
(5) *Fat:* Total calories — calories from carbohydrate and protein
$1728 - (308 + 710) = 710$ calories
$710 \div 9 = 78.9$ Gm. fat per day

By rounding off the numbers the prescription thus becomes: carbohydrate, 180 Gm.; protein, 75 Gm.; and fat, 80 Gm.

Distribution of Carbohydrate. It is essential that carbohydrate be properly distributed throughout the day. Whenever no insulin is being given the carbohydrate is divided into three equal parts. If regular insulin alone is used, the larger amounts of carbohydrate will be given at the meal immediately following the insulin; for

example, if insulin is given before breakfast and dinner, $\frac{2}{5}$ of the carbohydrate may be given at breakfast, $\frac{1}{5}$ at lunch, and $\frac{2}{5}$ at dinner. When protamine zinc insulin is given the carbohydrate is frequently divided into four, and sometimes six, meals instead of three. A light meal before retiring is advisable to avoid insulin reactions during the night. In addition to the stipulated amount of carbohydrate part of the day's allowance of protein should also be reserved for the bedtime meal so that the food will be slowly absorbed.

Planning the Type Diet. The calculation of the diet prescription is the physician's responsibility, but the nurse must know how to translate the factors into terms of common foods. She must fill the prescription from foods which will furnish these nutrients and which will also assure the patient of a sufficient amount of the essential minerals and vitamins. A type diet which lists classes of foods rather than specific foods is most practical since such a plan can be used day after day by substituting one food for another. There are a number of points to keep in mind while planning the type diet:

1. Adequacy of the diet for minerals and vitamins is most easily assured if one first plans to use the protective foods as milk, eggs, meat, fruit, vegetables, etc. Table II which is found in the Appendix (page 716) is of great value in the quick estimation of type diets.

2. The prescription must be accurately filled. The calculated daily totals for carbohydrate, protein, and fat should be within 2 to 3 Gm. of the prescribed totals. For example, if the prescription calls for 150 Gm. of carbohydrate, the type diet must allow not less than 147 Gm. nor more than 153 Gm. Moreover, the total carbohydrate allowance for each meal must be within 2 Gm. One need not be concerned about the meal distribution of fat and protein so long as the same type diet is followed from day to day.

3. The foods containing carbohydrate should be selected first. These may contain both protein and fat, which must be accounted for in filling the prescription. Milk should be included in this first estimation since it contains carbohydrate as well as protein and fat.

4. Meat, eggs, and cheese are then added to meet the prescribed protein total.

5. Fats are included last and a final adjustment is made of the diet so that all totals are within the allowable range.

6. The foods selected must satisfy the demands of the appetite.

Many diabetics break diet because the food ordered does not give a feeling of satiety even though the diet is adequate in every respect. It is wise, therefore, to fill the major portion of the carbohydrate allowance with foods of low carbohydrate content (as 3, 6, and 9 per cent vegetables, and 6, 9, and 12 per cent fruits), because foods of high concentration — such as sugars and starches — can be given in only small quantities. It makes little difference whether the classification employed for fruits and vegetables is the 3, 6, 9 per cent grouping, or whether the older 5, 10, 15 per cent classification is used. The point is to select one classification and use it to the exclusion of the other.

Incidentally, the fruits and vegetables of low-carbohydrate value which are chosen to fill the prescription will usually prove to be valuable sources of the vitamins, minerals, and cellulose which are so necessary in the normal diet.

7. The diet must be planned with proper consideration of the patient's economic status, religious and social customs, and personal idiosyncrasies.

The diet should be planned with the patient so that it can be adjusted to his pattern of living. Meals which must be carried in a lunch box, or eaten in a restaurant, present problems not encountered by the person eating at home. One must consider likes and dislikes; the diet is doomed to failure if foods are included which the patient never eats or if religious laws are ignored. For example, it would be folly to include meat and milk in the same meal for some Jewish patients.

Poor planning of diabetic diets may mean that some members of the family group will be deprived of adequate diets and other necessities in order to provide for the patient. The diabetic diet need not be an expensive one, and, ideally, it should be so planned that it fits in with the menus of the rest of the family.

8. Special "dietetic foods" should not be used since their cost is usually high, they add little in the way of palatability, and their composition is variable. For example, even though gluten bread is relatively low in carbohydrate, its increased protein finally is broken down to appreciable quantities of available glucose.

The calculation of the type diet for the prescription computed on page 386 is given below.

DIABETIC TYPE DIET

C=180 Gm. P=75 Gm. F=80 Gm.
(Carbohydrate division: breakfast, 30 Gm.; luncheon, 60 Gm.; dinner, 60 Gm.; bedtime, 30 Gm.)

	Household Measure	Weight Gm.	C Gm.	P Gm.	F Gm.
Breakfast					
Fruit	1 portion	*	10	1	..
Egg	1	50	..	7	6
Whole-grain bread or cereal	1 slice	30	15	3	1
Milk	½ cup	120	6	4	5
Butter	2 teaspoons	10	..	..	8
			31	15	20
Luncheon					
Cheese, American or Swiss	1 ounce	30	1	8	9
Vegetable, 6 per cent	½ cup	100	6	2	..
Whole-grain bread	2 slices	60	31	5	1
Butter	3 teaspoons	15	..	..	12
Fruit	1 portion	*	10	1	..
Milk	1 glass	200	10	6	8
			58	22	30
Dinner					
Lean meat, cooked	2 ounces	60	..	18	4
Potato	1 medium	120	23	2	..
Vegetable, 3 per cent	½ cup	100	3	2	..
Vegetable, 9 per cent	½ cup	100	9	2	..
Whole-grain bread	1 slice	30	15	3	1
Butter	2 teaspoons	10	..	..	8
Fruit	1 portion	*	10	1	..
			60	28	13
Bedtime					
Milk	1 glass	200	10	6	8
Saltines	4	15	11	1	2
Butter	2 teaspoons	10	..	..	8
Fruit	1 portion	*	10	1	..
			31	8	18
Totals for the day	....	....	180	73	81

* The weight of one portion of fruit will depend upon the kind of fruit used. One portion is, by definition, the amount of fruit which will supply 10 Gm. of carbohydrate. For example:

55 Gm. 18 per cent fruit contains 10 Gm. carbohydrate
65 Gm. 15 per cent fruit contains 10 Gm. carbohydrate
85 Gm. 12 per cent fruit contains 10 Gm. carbohydrate
110 Gm. 9 per cent fruit contains 10 Gm. carbohydrate
165 Gm. 6 per cent fruit contains 10 Gm. carbohydrate

The measures for fruit also vary with the kind of fruit used. For the amounts equivalent to one portion see the list of equivalents in the Appendix, page 720.

The following sample menu illustrates how a diet for one day may be planned by substituting individual foods in the type diet planned above.

Breakfast	Measure	Weight Gm.
Orange	1 small	85
Egg, poached	1	
Wholewheat toast	1 slice	30
Butter	2 teaspoons	10
Milk	½ cup	120
Coffee: NO SUGAR		
Luncheon		
Cheese sandwich		
Cheese, Swiss	1 ounce	30
Rye bread	2 slices	60
Butter	3 teaspoons	15
Raw carrot strips	1 medium carrot	65
Fresh blackberries	⅔ cup	110
Milk	1 glass	200
Dinner		
Chopped round steak	2 ounces	60
Potato, mashed	½ cup	120
Beets	½ cup	100
Sliced tomatoes and lettuce	medium salad	100
Wholewheat bread	1 slice	30
Butter	2 teaspoons	10
Cantaloupe	½ medium	165
Bedtime		
Milk	1 glass	200
Saltines	4	15
Butter	2 teaspoons	10
Peach	1 medium	110

Diabetes in Childhood. The principles of treatment for the diabetic child are essentially the same as for an adult, but certain additional factors must be considered. It is important to plan the diet to include suitable foods for a given age so that growth will take

place at a normal rate. For example, this means that a protein intake of 2 to 3 Gm. per kilogram of body weight must be allowed. The requirements stated for children in the standards of the National Research Council apply to the diabetic child as well (see page 223).

It is generally true that control of diabetes is somewhat more difficult in children; their smaller size makes it necessary to change food or insulin intake with caution. Coma and hypoglycemia are more common than in the adult, for the margin between hyper- and hypoglycemia is narrow.

In addition, diabetic children are faced with the danger of retarded growth. Dwarfism results primarily from gross dietary errors — keeping the diet low to avoid the use of insulin or giving too little food and too little insulin to keep the child in good nutrition. The most serious aspect of this situation is that the stunting or retarding of growth is an accomplished fact before the condition is apparent. Loss of weight is another danger from which the diabetic child must be guarded. When a child excretes a large quantity of glucose, he is losing calories which represent actual body weight.

A diet moderate in carbohydrate and fat is given by Joslin and White in Boston with effective results. The carbohydrate to fat ratio in this diet is 2 to 1 or 3 to 1. The question of stabilizing a diabetic child is sometimes difficult especially when there are complications. Desugarizing diets are used in the majority of cases. The following outline by Dr. White[5] has been found satisfactory.

"The technique of desugarization is arbitrary — under-nutrition, plus insulin, using a five day plan of desugarization according to age may be employed as follows:

Under 5 Years Insulin 3 + 3 + 3 +	Age 10 Years Insulin 5 + 5 + 5 +	Age 15 Years Insulin 10 + 10 + 10 +
C 100 — P 60 — Fat 60	C 120 — P 60 — Fat 60	C 140 — P 60 — Fat 60
110	130	150
120	140	160
130	150	170
140 60 70	160 70 80	180 80 90

Urine specimens are collected every two hours for qualitative, and every twenty-four hours for quantitative tests. Of most value are

the pre-meal and retiring specimens. The other specimens are obtained to avoid residual at the hours when it is desirable to study the metabolism of individual patients. If the 11:30, 4:30 and 9:30 specimens are clear, additional carbohydrate (from 5 to 10 grams) is given. If the tests are unsatisfactory, the insulin is increased the following day to anticipate the poor tests. Blood-sugar determinations are of value, fasting, and at 11:30 and 4:30 P.M. When fasting, they should be below 200 mgms. and at 11:30 and 4:30 P.M. they should be normal." Drs. Joslin and White measure the exercise as they do the diet, since they found that exercise without insulin raised the blood sugar. When there is trouble with the after-breakfast specimen, they advise insulin plus exercise plus diet in the sequence given.

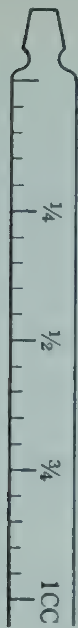
Once the dietary prescription has been arrived at for the child, the type diet and the daily menus are planned exactly as for the adult. It is necessary to change the prescription and the type diet from time to time to keep pace with the growth of the child, and the changing nutritive requirements.

INSULIN

When the body does not manufacture enough insulin, it must be supplied from other sources. The insulin which has revolutionized the treatment of diabetes was discovered by Banting and Best of Toronto, Canada in 1921 and made available to the public in 1922. It is now manufactured on a large scale by a patented formula from the pancreas of sheep. Today there are three types of insulin: (1) regular or unmodified insulin, (2) protamine zinc insulin, and (3) crystalline zinc insulin.

Insulin Unitage. Insulin must be injected since it is rendered inactive by the digestive juices when given by mouth. Insulin is measured in units, one unit usually being necessary for the oxidation of 2 Gm. of glucose. There is considerable variation, however, in the amount of glucose which can be oxidized in the presence of one unit insulin; with some regimens as much as 4 or even 5 Gm. of glucose have been utilized.

Insulin comes in solutions of various strengths, such as U-20, U-40, or U-80. This means that 1 cc. contains 20, 40, or 80 units,



Units of Insulin

U20	U40	U80	U100
1	2	4	5
2	4	8	10
3	6	12	15
4	8	16	20
5	10	20	25
6	12	24	30
7	14	28	35
8	16	32	40
9	18	36	45
10	20	40	50
11	22	44	55
12	24	48	60
13	26	52	65
14	28	56	70
15	30	60	75
16	32	64	80
17	34	68	85
18	36	72	90
19	38	76	95
20	40	80	100

Fig. 30.

Courtesy of Dr. Russell M. Wilder, Professor and Chief of the Department of Medicine, The Mayo Foundation for Medical Education and Research, University of Minnesota, Head of the Section of Metabolism Therapy, Division of Medicine, The Mayo Clinic, Rochester, Minnesota.

respectively. Thus, 1 cc. of U-40 insulin contains twice as many units as 1 cc. of U-20 insulin. Insulin may be given by a hypodermic syringe or with an insulin syringe (see Fig. 30).

Comparison of Various Types of Insulin. Protamine zinc insulin, a combination of insulin and protamine from the sperm of fish, was developed by Hagedorn of Copenhagen, Denmark. Its action more nearly parallels that of the normal insulin secreted in the body, since it is very slowly absorbed from the tissues into the blood stream. It is more stable and its keeping qualities are better. The duration of the effect of protamine zinc insulin is about 24 hours, the maximum effect being reached in from 12 to 24 hours after it is injected. Regular insulin, on the other hand, will be effective for 1 to 6 hours after injection. Because of its slow absorption protamine insulin is frequently accompanied by a small dose of regular insulin to take care of the glucose from breakfast. As the effect of protamine insulin is felt later, so the reactions from this type of insulin will be delayed in coming on. It should be remembered that protamine insulin must never be substituted for regular insulin except under direction of a physician.

EDUCATION OF THE PATIENT

Objectives of Instruction. The ultimate success of the treatment of diabetes is dependent upon the intelligent cooperation of the patient himself. The better informed the patient is with regard to the nature of his disease, its treatment, and possible complications, the greater are the chances that the given patient will enjoy a normal span of life with gainful occupation, and enjoyable leisure. One of the most important reasons for hospitalization of the new patient is the opportunity to begin instruction, both individually and in classes. This instruction should begin on the first day unless the patient is seriously ill. One must recognize the background and intelligence of the patient and adjust the methods of teaching accordingly.

Dietary Instruction. The patient should be taught (1) the reasons for a specified diet, (2) the size of portions, and (3) the substitutions which are possible on his diet. Dietary instruction should be simple but carefully given. The use of weighed and standardized portions in the hospital enables the patient to become familiar with the size of portions. It is not desirable for the patient to weigh his food at home since food composition is too variable to justify this. The ability to substitute one food for another and at the same time keep the total amount of carbohydrate, protein, and fat within the limits prescribed by the diet is absolutely essential in planning diabetic menus. Nothing favors breaking diet so much as serving the same foods over and over again. For most patients it is easier to limit the selection of foods to those not requiring recipes. As the patient becomes more accustomed to food computations he may be able to devise his own recipes.

Other Factors Requiring Emphasis. In addition to the dietary instruction, the patient needs to be taught (1) the method of insulin administration and the regulation of dosage, (2) the method for testing urine for sugar, (3) the importance of good hygiene and well regulated exercise, and (4) what to do when first symptoms of trouble appear. It is unquestionably important to emphasize the value of good habits. A reasonable amount of exercise is beneficial to the patient in that there is increased utilization of sugar. The amount of insulin required is somewhat less when one indulges in

moderate exercise. Diabetics should make every effort to maintain a calm, contented life, for worry, nervous strain, fear, or anger may sometimes undo weeks of careful regulation.

COMPLICATIONS OF DIABETES

Insulin Shock. Hypoglycemia means a blood-sugar concentration below the normal level. Symptoms do not appear, as a rule, until the blood sugar is below 70 mg. per 100 cc. The diabetic hypoglycemia or insulin shock may be caused by (1) an overdose of insulin, (2) a decrease in available glucose because of omission of food, or loss of food by vomiting or diarrhea, or (3) an increase in exercise without accompanying modification of the insulin dosage. The patient first becomes aware of uneasiness, nervousness, weakness, trembling, thirst, and excessive hunger. The pulse becomes rapid, and pallor, sweating, and fainting sensations ensue. If the hypoglycemia is not corrected there is incoordination of movement, lowered blood pressure, delirium, and convulsions with impending death. Laboratory tests show a very low blood sugar.

Orange juice, sugar, candy, syrup, honey, or any readily available carbohydrate may be given when there is impending insulin shock. Every patient who takes insulin should carry some sugar or hard candy with him for such emergencies. Further harm can usually be avoided by prompt ingestion of such carbohydrate. If the patient loses consciousness it is necessary to give large doses of glucose intravenously. Reactions from protamine zinc insulin come much later than those from unmodified insulin and may be of longer duration or recur after one to two hours. In such cases it has been found advisable to use some easily digested and soluble carbohydrate — such as syrup, honey, or sugar — to bring the patient out of the reaction, and to follow with milk, or bread and milk, in one to two hours to prevent a recurrence. The patient should be impressed with the importance of a strict adherence to the diet, because in this way reactions are much less frequent and it is far better to prevent reaction than to have to treat it.

Acidosis and Coma. The most dreaded complication in diabetes is the state of coma which is brought about by acidosis. Diabetic coma is the result of too much food, too little insulin, or infection. It is easy to prevent coma due to the first two causes by maintaining

always the proper balance between food and insulin. Infection is a particularly sinister influence, for the carbohydrate tolerance becomes lower even in mild infections and severe acidosis may occur before insulin dosage has been appropriately increased. In other words the failure to utilize glucose results in increased accumulation of the lower fatty acids and resultant acidosis. The ketone bodies appear in the urine. The patient first complains of headache, anorexia, nausea, and vomiting. He usually becomes restless and may experience abdominal pain and colic. If the patient does not receive insulin to aid in the use of glucose, drowsiness, extreme weakness, painful, rapid breathing and finally coma result. Death may follow unless prompt and drastic measures are taken.

Recognition of the symptoms occurring in diabetic acidosis and coma and the ability to distinguish them from the symptoms existing in hypoglycemia are of the utmost importance, because the life of the patient may depend upon prompt and drastic measures. The following outline shows the chief differences between the coma induced by acidosis and that brought about by insulin reaction.

DIFFERENTIATION OF TWO TYPES OF COMA

Symptoms	Insulin Shock	Diabetic Coma
Onset	Sudden — minutes	Gradual — hours, even days
Appearance	Weak, but does not look critically ill	Looks, and is, critically ill
Skin	Moist; profuse perspiration	Hot and dry
Respiration	Normal	Rapid, gasping — air hunger
Odor	None	Acetone breath; fruity odor
History		
Food	Too little	Too much
Insulin	Too much	Too little
Gastro-Intestinal upsets	None	Vomiting
Blood sugar	Below 70 mg.	High
Urine sugar	Second specimen negative	Always positive
Diacetic acid in urine	Negative	Positive
Blood CO_2	Normal	Low — 20 to 30 volumes per cent

(Courtesy of Dr. Jacob Alperin, University of Tennessee)

Treatment of acidosis and coma is strictly a medical problem and to be directed by a physician only. Heroic doses of insulin are started immediately. For an adult, Wilder[6] advises 50 to 100 units

of protamine zinc insulin injected in one hypodermic site and 20 to 40 units of unmodified insulin in another. The insulin dosage is regulated by the physician according to the results of blood and urine examinations. As a rule additional doses of regular insulin are given at two- to three-hour intervals. Fifteen units of regular insulin are given for grade 4 reaction to Benedict's test for sugar in the urine, 10 units of insulin for grade 3 reaction, and 5 units for grade 2 reaction. If there is no reaction administer 10 Gm. of glucose. Physiologic salt solution is given intravenously for the next 24 hours to correct the dehydration. At the expiration of two to three hours if the patient is not nauseated, small amounts of sugar in orange juice or as a 10 per cent solution of dextrose may be given by mouth or duodenal tube every two or three hours. If the patient is nauseated, 150 cc. of 10 per cent glucose solution may be administered intravenously every three hours. Bicarbonate solution is frequently included in the treatment of acidosis.

For the first few days following recovery from coma, care will be taken to prevent the recurrence of the condition. The diet is planned to avoid an excess of fat and protein intake. The liquid diet used after or during coma is administered at three- to four-hour intervals. As a rule unmodified insulin is given at regular intervals. In the planning of fluid diets it is necessary to calculate the carbohydrate values only.

Diabetes and Surgery. The diabetic patient as well as the nondiabetic individual should have a good store of glycogen in order to best withstand surgical procedures. That reserve can be assured only if (1) sufficient foods of high carbohydrate content are given up to 12 hours before operation and (2) if insulin is supplied in great enough amounts to oxidize the carbohydrate. It is advisable to give fluids in abundance. In emergency operations where there is impending coma and acidosis it is usually necessary to give parenteral glucose and saline.

Carbohydrate feedings should be begun within three hours after operation as a rule. Orange juice, ginger ale, oatmeal water gruel may be allowed the first 24 hours. At least 100 Gm. of carbohydrate should be given in the first 24 hours — by vein if not practical by mouth.

Arteriosclerosis. Diabetic persons are particularly apt to develop

arteriosclerosis. Early sclerotic changes can be avoided by keeping the blood sugar within normal limits and by controlling infection and acidosis. The patient suffers from inadequate circulation, especially in the limbs, which if severe may result in the development of infections, ulcers, and gangrene. Daily cleanliness and careful protection of the feet is of first importance in the prevention of gangrene.

Infection. Any infection intensifies diabetes, because the carbohydrate tolerance is lowered. A mild diabetic may become a severe case, and in untreated diabetes infections may precipitate coma. If a patient who is not taking insulin develops an infection, the physician usually orders insulin, at least temporarily, until the infection subsides. The urine is examined several times a day for sugar and diacetic acid. The diet may be changed to an emergency diet of fruit juices, broth, etc. The carbohydrate intake is not restricted, but the proteins and fats are temporarily reduced.

Diabetes in Pregnancy. Glycosuria is of relatively frequent occurrence in pregnancy and it is thus necessary to distinguish it from the true glycosuria of diabetes. The diabetic woman who is pregnant requires an increase in her diet during the last trimester and corresponding adjustment of insulin dosage. Diabetes increases the hazards of pregnancy because of dangers of glycogen depletion, hypoglycemia, acidosis, and infection. The diabetic mother should not be permitted to nurse her baby as lactation is an additional strain.

SUMMARY

Diabetes mellitus is a disease of metabolism in which the body tissues are unable to adequately oxidize glucose because of the lack of insulin, a secretion of certain cells of the pancreas. When the glucose cannot be used by the tissues it accumulates in the blood until finally it spills over into the urine. Associated with this condition is the excessive breakdown of fatty acids in an effort to furnish the necessary energy, so that ketones also accumulate and eventually cause acidosis. The liver, adrenal, pituitary, and thyroid glands are also involved in the etiology of diabetes.

Heredity and obesity are the most important predisposing factors in diabetes.

The most characteristic symptoms of diabetes are polyuria, polydipsia, polyphagia, hyperglycemia, and loss of weight together with general weakness.

The basal metabolism in diabetes is normal for the well nourished individual. The dietary treatment is directed toward the correction of the faulty metabolism by reducing the blood sugar to the normal level and avoiding glycosuria, to improvement of the carbohydrate tolerance, and to avoidance of complications.

The daily protein allowance is 1 to 1½ Gm. per kilogram of body weight for the adult, and 2 to 3 Gm. per kilogram for children. Calories are adjusted to maintain the adult's weight at 5 to 10 pounds below normal, and to promote normal growth in the child. The non-protein calories are divided between fat and carbohydrate, allowing 40 to 60 per cent of these calories to be derived from carbohydrate and the remainder from fat. The minimum allowance of carbohydrate per day should be about 100 Gm.

When the body does not manufacture enough insulin to metabolize a diet which is essential for adequate nutrition it is necessary to supply exogenous insulin. This may be given as the quick-acting regular or unmodified insulin, or may be administered as the slow-acting protamine zinc insulin. The two types of insulin must not be confused.

The patient must be taught the importance of adhering strictly to a diet planned especially for him. He should be familiar with the substitutions which are possible on his diet. He needs, further, to be able to administer his own insulin, to test his urine to determine the regulation of insulin dosage, to know what to do when signs of trouble appear.

Insulin shock is caused by too large a dose of insulin, too little food, or increase in exercise. It produces a lowered blood sugar so that weakness, trembling, nervousness, excessive hunger, and eventual unconsciousness take place. Every diabetic should recognize the early symptoms of insulin shock and should always carry sugar or candy to take when such signs appear.

Diabetic coma is usually preventable. It is caused by too much food, too little insulin, or infection. The patient becomes hot, flushed, dehydrated, and critically ill. The blood sugar is so high that glycosuria is also present. Ketones accumulate and acidosis

results. The treatment of diabetic coma requires heroic doses of insulin together with glucose. Such treatment is always under a physician's guidance.

Arteriosclerosis, surgery, infections, and pregnancy are complications which require special consideration in the regulation of diabetes.

PROJECTS

1. Plan a prescription and a type diet for a man who works in a factory and who must carry his lunch. He is 69 inches tall and weighs 220 pounds. He is 45 years old.

2. Outline a plan of instruction for a patient such as the one described in problem 1.

REVIEW QUESTIONS

1. What is diabetes mellitus? What is its cause?

2. Name the important predisposing factors in diabetes.

3. What are the outstanding symptoms of diabetes?

4. How is the metabolism of each of these factors altered in diabetes: total energy metabolism; protein; carbohydrate; fat?

5. On the basis of the modified metabolism in diabetes, what should be the objectives for treatment? What changes would you make in the diet with respect to each nutrient?

6. List eight points to observe in the planning of the diet for the diabetic patient.

7. Compare the types of insulin commonly used for treatment of diabetes.

8. What is meant by U–40? U–80?

9. What are the characteristic symptoms of overdosage of insulin?

10. What treatment is effective for insulin shock?

11. What features distinguish insulin shock from acidosis?

12. How is acidosis treated?

13. What dietary modification would be necessary in each of the following circumstances: for a child of 7 years; for a patient who has hyperthyroidism; for a woman who is five months pregnant; for a patient who is to have an operation in two days; for a patient who has just had a cholecystectomy?

14. Be able to define or explain each of the following:
    a. Hypoglycemia
    b. Hyperglycemia
    c. Glycosuria

d. Renal threshhold
e. Glucose tolerance
f. Available glucose of a diet
g. Total fatty acid of a diet
h. Ketone body
i. Carbohydrate classification of fruits and vegetables

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CHAPTER XXIX

Diet in Other Glandular Disturbances

HYPERINSULINISM

Functional hyperinsulinism is a metabolic disorder in which there is an excessive production of insulin by the Islands of Langerhans with the result that the blood sugar is lowered to such a level that the symptoms of hypoglycemia occur. The patient becomes weak, nervous, extremely hungry, perspires freely, trembles, and may even lose consciousness. Convulsions occur occasionally. These symptoms are usually noticeable two to three hours after meals or during the night. The cause of this condition is not known.

Hyperinsulinism was first recognized by Dr. Seale Harris in 1924, and is distinct from the hypoglycemias which occur in Addison's disease and in hepatic failure. It is just the reverse of diabetes mellitus, for the latter is characterized by hypoinsulinism and hyperglycemia.

Modifications of the Diet. The successful dietary treatment of hyperinsulinism requires the same care in planning as that used in the diabetic diet. It is extremely important to differentiate between functional hyperinsulinism and the hypoglycemias which occur in Addison's disease or in hepatic disease. In the latter disorders a high carbohydrate diet is indicated for the correction of the low blood sugar (see Addison's disease, page 404; and Diet in Liver Diseases, Chapter XXVII), but in the hypoglycemia caused by excessive pouring out of insulin by the pancreas it has been found that high carbohydrate intakes can be definitely detrimental. The modifications described here are those for true hyperinsulinism.

Carbohydrate. Paradoxical as it may seem, the intake of carbohydrate is restricted in the diet for functional hyperinsulinism. This is necessary since carbohydrate is a stimulus to insulin secretion; as soon as the blood sugar rises following the ingestion of carbohydrate the flow of insulin begins and the blood sugar falls to very

low levels so as to quickly bring about a hypoglycemic attack. While the patient may experience immediate relief following the consumption of carbohydrate, such relief will be only temporary and the subsequent attacks a few hours later will be more severe. Various low levels of carbohydrate have been recommended but most of the plans restrict this nutrient to 120 Gm. or less daily, with greater emphasis on levels below 100 Gm.

Protein. A high-protein diet has been advocated (Conn[1]) since it has been found that there is no appreciable increase in the blood sugar level following high protein meals even though protein furnishes approximately 50 per cent of its weight in available glucose. This available glucose is released to the blood stream so gradually that there is no stimulation to the Islands of Langerhans. A daily intake of 120 to 140 Gm. of protein is desirable. Other physicians recommend a normal protein intake but much higher levels of fat.

Fat. When the levels of carbohydrate and protein have been established the remaining calories needed are obtained from fat. Some physicians[2] recommend a high-fat, low-carbohydrate, normal protein diet.

Minerals and Vitamins. The requirement for minerals and vitamins remains essentially normal. It is important that the type diet be so planned that it will include adequate amounts of these nutrients.

Planning the Daily Diet. A type diet is calculated just as one would calculate a diabetic type diet (page 387), using the prescription advised by the physician for the patient in question. One plan (Beeuwkes[3]) suggests that the initial diet contain 120 to 140 Gm. of protein and 75 Gm. of carbohydrate with the rest of the needed calories coming from fat. If the patient does not show improvement on this regimen, a diet which contains only 50 Gm. of carbohydrate should be tried.

With a moderate protein intake the dietary prescription might be: 60 to 75 Gm. protein; 90 to 120 Gm. carbohydrate; remaining calories from fat.[2]

Insofar as practical the protein and carbohydrate should be divided in three equal parts so that there is a constant rate of glucose released in the blood stream. It has been suggested that the patient should weigh his food for a few weeks until he becomes accustomed to the size of portions allowed.

ADDISON'S DISEASE

Addison's disease is a comparatively uncommon condition resulting from impaired function of the cortex of the adrenals. Tuberculosis is a known etiologic factor, but there are, no doubt, many other unknown causes. The disease is first characterized by loss of appetite, particular dislike of fatty foods, extreme weakness, fatigue, and a tan to bronze pigmentation of the skin. Gastro-intestinal disturbances as vomiting and severe diarrhea lead to marked weight loss. The blood pressure is low and secondary anemia is present in varying degrees. Untreated, the condition progresses to a fatal termination in one to two years.

Metabolism. There are two fundamental disturbances in metabolism. First, the salt balance is upset in that sodium chloride is excreted in the urine in excessive quantities, and the blood sodium content becomes abnormally low. There is an inability to excrete potassium so that the latter piles up in the blood. A diet high in potassium and low in sodium is sometimes used as a diagnostic aid in studying these metabolic changes.

The second disturbance is in the carbohydrate metabolism. Many patients show a low fasting blood sugar and a flat glucose tolerance curve indicating impaired carbohydrate absorption (see page 490). On the other hand, in these same patients, carbohydrate may be burned so rapidly that glycogen stores are quickly depleted. Symptoms of hypoglycemia may develop after only five to six hours of starvation. Furthermore, such patients seem to be unable to readily convert protein to carbohydrate.

Modifications of the Diet. Early dietary treatment was directed to the correction of the faulty mineral metabolism. A high-sodium chloride, low-potassium diet was therefore given[4]. Such a diet contains 10 to 40 Gm. sodium chloride and 1 to 2 Gm. potassium daily. To restrict the potassium sufficiently it is necessary to avoid such foods as concentrated sauces, meat stock and soup, whole grain cereals, dried fruits and vegetables, nuts, cocoa and chocolate, and to limit the quantities of meats and vegetables. Meats and vegetables are cut in small pieces and cooked in a large amount of water to extract as much of the potassium as possible. However, such cookery is deleterious to the flavor, as well as to the water-soluble vitamin content. Concentrates of the vitamin B complex are usually

prescribed to correct such losses. The diet is made high in sodium by giving as much salt as the patient will eat on his food and supplementing with 1 Gm. sodium chloride hourly in tablet form or as a salt solution. Liberal fluid intakes are important. The student is referred to the original article[4] for exact instructions in planning this diet since success is dependent on following carefully the somewhat detailed instructions.

The availability of Percoten (desoxycorticosterone acetate), a synthetic hormone, since 1937 has revolutionized the treatment of Addison's disease. Whenever it can be obtained it is usually the treatment of choice since with it a more nearly normal diet is possible, and the patient's progress is more satisfactory. The modifications of the diet (Hesser[5]) when desoxycorticosterone acetate is given include:

Protein. A slightly increased allowance of protein, about $1\frac{1}{2}$ to 2 Gm. per kilogram of body weight per day, is advisable.

Carbohydrate. A liberal intake of carbohydrate, 7 to 8 Gm. per kilogram of body weight per day, is necessary, especially for those patients who show abnormal absorption and increased utilization.

Minerals. Additional sodium salts in moderate quantities are sometimes, though usually not, required. The synthetic hormone is a "sodium retaining" factor, and the high-sodium, low-potassium diets are not necessary. In fact, restriction of potassium when Percoten is used may be dangerous.

Vitamins. An increase of thiamine may prove to be beneficial.

Intervals of Feeding. The constant need for carbohydrate together with the fickle appetite make it necessary to give frequent feedings — usually three meals with three intermediate feedings. Night feedings (midnight and 4 A.M.) may sometimes be required if hypoglycemic symptoms are present, but as a rule they are not necessary if the 9 to 10 P.M. feeding contains 25 to 50 Gm. of carbohydrate in easily utilized form.

Planning the Daily Diet. The high-carbohydrate diet outlined on pages 261 and 377 is suitable for these patients. It need not necessarily be low in fat, except insofar as the patient shows an intolerance to fat. The prevalence of vomiting and diarrhea may make it advisable to use a high-carbohydrate soft diet.

HYPERTHYROIDISM

Hyperthyroidism is a constitutional disturbance in which there is an excessive secretion of the thyroid gland, and a consequent increase in the metabolic rate. The disease is sometimes known as exophthalmic goiter or Grave's disease. The chief symptoms are emaciation, excessive nervousness, protruding eyes, and a generally enlarged thyroid gland. It may sometimes be accompanied by severe vomiting and diarrhea.

Metabolism. All of the metabolic processes in the body are accelerated in hyperthyroidism:

Energy. The basal metabolic rate is increased markedly, it being in many cases more than 50 per cent greater than the normal rate. The patient tends to be restless and irritable so that the total energy metabolism is also increased.

Protein. High rates of nitrogen metabolism may lead to destruction of tissue proteins. Loss of weight may be rapid unless both protein and calories are adequate to compensate for the raised metabolism.

Glycogen. The body reserves of glycogen are rapidly depleted if the dietary caloric level is insufficient. This depletion is especially serious if the patient is going to have an operation, for postoperative shock is very likely to ensue if the tissues are glycogen starved.

Minerals. There have been reports of increased calcium and phosphorus excretion in hyperthyroidism, indicating a greater need for these minerals.

Vitamins. There is a close relationship between vitamin A and the function of the thyroid gland. The utilization of vitamins, especially vitamin A, thiamine, and ascorbic acid, is speeded up in hyperthyroidism.

Modifications of the Daily Diet. The acceleration of all metabolic processes in hyperthyroidism makes it imperative that the patient consume quantities of food which might ordinarily seem excessive, if a state of good nutrition is to be maintained. Satisfactory progress is more readily attained when the patient is resting in bed. At any rate, one should emphasize the importance of adequate rest.

Energy. Since weight loss has almost invariably taken place, the diet should contain enough calories to effect a gain in weight. No

arbitrary level can be given. If, for example, a patient's basal metabolic rate is increased by 50 per cent, it is necessary to increase his dietary calories by 50 to 75 per cent to compensate for the additional metabolism. One patient will make satisfactory progress on 4000 calories daily while another requires 5500 calories before he can bring about a weight gain. The important thing to remember is: an increase in weight indicates glycogen storage; without glycogen storage the patient is a poor surgical risk.

Minerals. The allowance for all minerals, especially calcium and phosphorus, should be liberal.

Vitamins. The intake of all of the vitamins should be increased, with special reference to vitamin A, thiamine, and ascorbic acid. In some patients it may be advisable for the physician to prescribe vitamin concentrates.

Planning the Daily Diet. The high-calorie, high-vitamin, high-protein diet described on page 274 is suitable for the patient with hyperthyroidism. If the condition is accompanied by gastro-intestinal disturbances it may be necessary to modify this diet to one of soft consistency.

As a rule, these patients have good appetites and it is not difficult to get them to take the required amounts of food. Three meals a day with three intermediate feedings are advisable. One must be familiar with all the ways in which the diet may be padded without increasing the bulk excessively. Effective reinforcing agents include: butter or enriched margarines not only on bread but also used liberally to flavor vegetables; light cream mixed with an equal quantity of milk for use in beverages; mayonnaise and other salad dressings; peanut butter; glucose (cerelose) instead of sugar as a sweetening agent; jelly and hard candies. Foods which are high in carbohydrate are to be preferred to large quantities of bulky, low carbohydrate foods. Bread, potatoes or potato substitutes, cake, cookies are excellent for their carbohydrate content.

When a patient has a poor appetite it is necessary to use the best possible psychological approach to the problem. A tray which is overloaded with food is likely to discourage as well as nauseate the patient. It is better, then, to serve only such quantities of food as the patient is likely to eat, and to supply second portions when all food has been consumed. In stepwise fashion the caloric intake

is increased from day to day. While it is important to employ concentrated foods for these patients, one must guard carefully against further nauseating the patient by oversweet or overrich foods. One can frequently obtain the patient's cooperation by charting with him his weight and his daily caloric intake so that he can see the progress he is making. When other patients with similar problems are about, a spirit of competition with one another may help. For some individuals a dogmatic insistence on the eating of food may be necessary — if not as mere food, then as medicine which will help overcome the condition. For others the promise of more rapid recovery, earlier return to one's family, and lessened financial burdens may be a stimulus. By knowing her patient, the nurse can determine the appropriate psychological approach.

SIMPLE GOITER

Simple goiter is a deficiency disease caused by a lack of sufficient iodine to produce thyroxin with the normal iodine content. The thyroid gland enlarges in an attempt to compensate for the deficiency and may at times grow to enormous size.

The disease occurs more frequently in girls than in boys and is likely to develop at puberty. The pregnant woman is also more prone to its effects, which may be manifested in the fetus as well. Simple goiter is more prevalent in regions where the soil lacks iodine, and the foods and water show a marked deficiency of iodine salts. The student should review the discussion of iodine in the chapter on Mineral Elements, page 55.

Prevention of Simple Goiter. Simple goiter is a preventable disease. In regions where goiter prevails, the use of iodized salt by pregnant women and by children through adolescence should be emphasized as a prophylactic measure.

Sea foods are the richest sources of iodine, but fresh-water fish are not to be classed with salt-water fish and shellfish. Vegetables grown in non-goiterous regions generally supply enough iodine for health. However, in these days of ready transportation of foods from one part of the country to another, one cannot always rely on vegetables being grown on soils rich in iodine.

The treatment of simple goiter should be prescribed by the physician who will supply proper amounts of iodine as a medication.

MYXEDEMA

If deficiency of iodine is severe, there will be such a marked deficit of the thyroid hormone that myxedema results. This is a grave condition in which not only the physical but also the mental well-being of the individual is involved. It is characterized by edema, a lowered rate of energy metabolism, muscular flabbiness and weakness, marked fatigue on slight exertion, and mental sluggishness. The condition responds frequently to the giving of thyroxin, as the accompanying illustration will show (Fig. 31).

Courtesy of Dr. E. C. Kendall

Fig. 31. Photographs of a Young Woman Before and After the Cure of Myxedema by Thyroxin

Besides the disappearance of the edema, note the increased mental alertness evident in the second photograph.

SUMMARY

Hyperinsulinism. This is a condition in which there is an excessive secretion of insulin by the Islands of Langerhans and a resultant hypoglycemia. Carbohydrate acts as a stimulus to the flow of insulin, and is therefore restricted in the diet. The diet is planned in the same manner as a diabetic type diet with normal- to high-protein levels, moderate- to high-fat levels, and low-carbohydrate levels — not to exceed 120 Gm.

Addison's Disease. This condition is thought to result from a destruction of the adrenal cortex by tuberculosis or some other as yet

undiscovered cause. It is accompanied by gastro-intestinal disturbances — nausea, vomiting, and diarrhea, great weakness, skin pigmentation, and low blood pressure. The patient excretes abnormal amounts of sodium chloride but retains potassium. The carbohydrate metabolism is high. With the use of desoxycorticosterone acetate the diet is normal except for a high carbohydrate intake, and a moderately increased protein allowance. When the synthetic hormone is not used the diet must be very restricted in potassium, while the sodium chloride content is raised by means of salt tablets or salt solutions. The low-potassium diets require special methods of preparation, and the foods lose some of their flavor and some of their water-soluble vitamins.

Hyperthyroidism. In hyperthyroidism the enlarged thyroid gland excretes abnormal amounts of thyroxin which speeds up metabolism to a great extent, breaking down body cells and resulting in excessive loss of weight.

The diet must cover the increased metabolic rate and compensate for the nitrogen losses. Calories are increased 50 to 75 per cent above the normal, the daily diet containing approximately 4000 to 5500 calories. About $1\frac{1}{2}$ Gm. of protein per kilogram of body weight are allowed per day. The diet is given in three meals with three intermediate feedings. The use of reinforcing agents makes it possible to bring the calories to the desired amount. When the patient has no desire to eat, he must be impressed with the therapeutic value of food and the importance of eating all that is served to him.

Plenty of sleep at night and one or two hours of rest during the day are important. Unnecessary movements should be avoided as far as possible.

Simple Goiter. This is a deficiency disease caused by lack of iodine, and characterized by enlargement of the thyroid gland. It occurs especially in pregnant women and in children through the age of adolescence. It is preventable, since the use of iodized salt in goiterous regions is an entirely safe prophylactic measure.

Myxedema. Severe deficiency of secretion of the thyroid gland leads to markedly lowered metabolism, dulling of the mental processes, and physical sluggishness — a condition known as myxedema. It may be treated by the administration of thyroxin.

PROJECTS

1. Calculate a type diet for a patient with hyperinsulinism who requires 2400 calories, 130 Gm. protein, and 75 Gm. carbohydrate. Give a sample menu for this type diet.

2. Plan a high-carbohydrate, soft diet in six feedings for a patient with Addison's disease who weighs 145 pounds. Calculate the carbohydrate content of this diet.

3. Plan a diet containing at least 4500 calories which is suitable for a patient with hyperthyroidism.

REVIEW QUESTIONS

1. What is meant by hyperinsulinism? What are its symptoms?

2. Why is it important to distinguish between functional hyperinsulinism, Addison's disease, and liver diseases before planning the diet?

3. What is the effect of a high carbohydrate intake on a patient with hyperinsulinism?

4. What dietary regimen would you advise for a patient with hyperinsulinism?

5. What are the chief symptoms of Addison's disease?

6. In what ways is the metabolism in Addison's disease altered?

7. What are the outstanding characteristics of dietary treatment for Addison's disease when the patient is receiving Percoten? List those which are important for patients not receiving the hormone. How do you account for these differences?

8. Why is a soft diet frequently necessary for patients with Addison's disease?

9. What is hyperthyroidism? What are the characteristic symptoms?

10. Outline the modifications of the diet which are necessary for the treatment of hyperthyroidism.

11. List five ways in which you might bring about more satisfactory food intake by a patient with hyperthyroidism.

12. Why does a surgeon so frequently insist that a patient gain weight before an operation on the thyroid?

13. What is simple goiter? How may it be prevented?

14. What is myxedema? What is its chief cause? How is it treated?

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CHAPTER XXX

Diet in Epilepsy and Nervous Disturbances

The Nature of Epilepsy and Its Treatment. Epilepsy is a nervous disease characterized by seizures, convulsions, and loss of consciousness, the cause of which is unknown. The treatment of the disease has been the subject of much discussion, and a number of diets have been advocated; but the consensus of opinion seems to be that the ketogenic diet produces the most satisfactory results. This diet originated at the Mayo Clinic but is widely used, especially in the treatment of epileptic children. The purpose of the diet is to produce an acidosis by markedly increasing the intake of fat, and at the same time curtailing very severely the amount of available glucose. There is usually an accumulation of ketone bodies, or the desired acidosis, when the ratio of fatty acids to available glucose is greater than 2 to 1. It will be remembered that the sources of fatty acids are 90 per cent of food and body fats, and 46 per cent of food and body proteins, while available glucose may be derived from 100 per cent of dietary carbohydrate plus 58 per cent of food or body proteins and 10 per cent of food or body fats. (Refer to page 418 for calculation of the ratio.) According to Fay[1] the dehydration brought about by the restriction of fluids in the ketogenic diet is more important than the acidosis.

Modification of the Diet. In order to bring about a state of acidosis and at the same time maintain adequate nutrition, the following modifications are necessary:

Energy. Sufficient calories for normal weight are necessary. An allowance of 16 calories per pound of body weight is usually adequate for adults, while 25 calories per pound of body weight are necessary for children.

Protein. The allowance of protein for adults is $\frac{2}{3}$ Gm. per kilogram of body weight, and 1 Gm. per kilogram of body weight for children. If growth is not satisfactory, the child's allowance is in-

creased to $1\frac{1}{2}$ Gm. per kilogram of body weight. The use of protein up to 2 Gm. per kilogram is recommended by McQuarrie[2] who feels that the lower levels may be inadequate for the maintenance of nitrogen equilibrium during a state of ketosis.

Fat. Most of the caloric value of the diet is supplied by fats which are necessarily high in order to effect ketosis.

Carbohydrate. The level of carbohydrate is kept low enough to produce the desired degree of ketosis. It should never be less than 10 Gm. daily, and usually needs to be less than 30 Gm. if ketosis is to be produced.

Minerals and Vitamins. The ketogenic diet is apt to be dangerously low in calcium, iron, and the water-soluble vitamins. Since the regimen must be used for a long time before results are assured, it is essential that the diet be properly supplemented with calcium for the growing child and with vitamin concentrates or brewer's yeast.

Fluids. The intake of fluids is usually restricted to 600 cc. or less daily at the beginning of treatment and is kept distinctly low for several months according to the condition of the patient.

Adjustment of the Diet. It is not advisable to make too sudden a change from the regular diet in which the carbohydrates are abundant and the fats are moderate, to a diet in which the carbohydrates are necessarily low and the fats comparatively high, because nausea is likely to occur. Even when the change is brought about gradually, nausea and vomiting may result.

Two procedures are commonly used to institute the change from a regular diet to a ketogenic diet. With adults a short period of starvation initiates the acidosis which is subsequently maintained with the ketogenic diet. During this period only 8 ounces of orange juice and non-caloric bran wafers are given daily.

The starvation regimen is not advisable for children. To avoid nausea, which may occur when too rapid a change is made from the normal diet, it has been found practical to place the patient on a diet containing 75 Gm. of carbohydrate the first day, reducing this to 50 Gm. the second day and to 30 Gm. the third day. On the fourth day the prescription is given. If nausea develops at any stage during the reduction of carbohydrate, small amounts of orange juice are given, and the diet is not further reduced until the nausea

has disappeared. Sometimes nausea and vomiting occur in the course of the treatment, in which case a return to a more general diet for a day or two will overcome the disturbance and permit a resumption of the ketogenic diet.

Calculation of the Diet. It must be remembered that the requirement of each individual patient must be calculated. To illustrate the method of calculating the diet prescription, we will take a child weighing 100 pounds.

(1) Calories: $100 \times 25 = 2500$
(2) Protein: 0.5 to 0.7 Gm. per pound
$100 \times 0.5 = 50$ Gm.
(3) Calories from protein: $50 \times 4 = 200$
(4) Calories from carbohydrate and fat: $2500 - 200 = 2300$

If we allow 75 Gm. of carbohydrate on the first day, the fat intake will need to be 222 Gm., as noted in the following calculation:

(5) Calories from carbohydrate: $75 \times 4 = 300$
(6) Calories from fat: $2300 - 300 = 2000$
(7) Grams of fat: $2000 \div 9 = 222$

Thus we have a formula for the first day of the treatment which reads:

Carbohydrate	75 grams
Protein	50 grams
Fat	222 grams

On the second day the carbohydrate is reduced 25 Gm. to bring the intake down to 50 Gm. The loss of 100 calories from the reduced carbohydrate (25×4) is made up by adding 11 Gm. of fat ($11 \times 9 = 99$ calories), and the formula now reads:

Carbohydrate	50 grams
Protein	50 grams
Fat	233 grams

On the third day a further reduction of 20 Gm. in the carbohydrate intake is made, and again the loss of 80 calories (20×4) from the reduced carbohydrate must be made up by adding 9 Gm. of fat ($9 \times 9 = 81$ calories), and the formula reads:

Carbohydrate	30 Gm.
Protein	50 Gm.
Fat	242 Gm.

DIET CALCULATION TABLE

Cals.	Ratios													
	1	1	1.5	1	2	1	2.5	1	3	1	3.5	1	4	1
	F	C^+P	F	C^+P	F	C^+P	F	C^+P	F	C^+P	F	C^+P	F	C^+P
1000	77	77	86	57	91	45	94	38	97	32	99	28	100	25
	79	79	88	59	93	47	97	39	99	33	101	29	102	26
	81	81	90	60	96	48	99	40	102	34	104	30	105	26
	83	83	92	61	98	49	101	41	104	35	106	30	107	27
1100	85	85	94	63	100	50	104	41	106	36	108	31	110	27
	87	87	96	64	102	51	106	42	109	36	111	32	112	28
	88	88	99	66	105	52	108	43	111	37	113	32	115	29
	90	90	101	67	107	53	111	44	114	38	116	33	118	29
1200	92	92	103	69	109	55	113	45	116	39	118	34	120	30
	94	94	105	70	111	56	116	46	118	40	121	34	122	31
	96	96	107	71	114	57	118	47	121	40	123	35	125	31
	98	98	109	73	116	58	120	48	123	41	126	36	127	32
1300	100	100	111	74	118	59	123	49	126	42	128	37	130	32
	102	102	114	76	120	60	125	50	129	43	130	37	132	33
	104	104	116	77	122	61	128	51	130	43	133	38	135	34
	106	106	119	78	124	62	130	52	132	44	136	39	138	34
1400	108	108	120	80	128	64	132	53	135	45	138	40	140	35
	110	110	123	82	130	65	135	54	138	46	141	40	142	36
	112	112	125	83	132	66	137	55	141	47	143	41	144	36
	113	113	126	84	134	67	139	56	143	48	146	42	146	37
1500	115	115	129	86	136	68	141	57	144	48	148	42	150	38
	117	117	131	87	138	69	144	58	147	49	150	43	152	38
	119	119	134	89	140	70	146	59	150	50	152	44	156	39
	121	121	135	90	144	72	150	60	153	51	155	44	158	39
1600	123	123	137	91	146	73	151	60	156	52	157	45	160	40
	125	125	140	93	149	74	153	61	158	53	161	46	162	41
	127	127	143	94	150	75	155	62	159	53	163	47	165	41
	129	129	144	96	152	76	158	63	162	54	165	47	168	42
1700	131	131	146	97	154	77	160	64	165	55	168	48	170	43
	133	133	149	99	156	78	163	65	168	56	170	49	172	43
	135	135	150	100	158	79	165	66	170	57	172	49	176	44
	137	137	152	101	162	81	168	67	171	57	175	50	178	44
1800	138	138	155	103	164	82	170	68	174	58	177	51	180	45
	140	140	156	104	166	83	173	69	177	59	179	51	182	46
	142	142	158	105	168	84	175	70	179	60	182	52	185	46
	144	144	161	107	170	85	178	71	180	60	185	53	188	47

NOTE. To simplify the calculation of the diet and to obtain the *FA/G* desired, the above table is included. The protein is based on the individual's protein requirements—$\frac{2}{3}$ to 1 Gm. per kg. of body weight. The number of calories required is located on the table and the desired ratio selected to furnish this number of calories. The amount of protein required is then deducted from the figures given in the column marked *C^+P*. The remainder represents the amount of carbohydrate which will be required to give the desired ratio, or *FA/G*.

Massachusetts General Hospital *Courtesy of E. H. Luther and W. M. Bartlett*

DIET CALCULATION TABLE (Cont'd)

Cals.	Ratios													
	1	1	1.5	1	2	1	2.5	1	3	1	3.5	1	4	1
	F	C+P	F	C+P	F	C+P	F	C+P	F	C+P	F	C+P	F	C+P
1900	146	146	162	108	172	86	180	72	183	61	187	54	190	48
	148	148	165	110	176	88	183	73	186	62	189	54	192	48
	150	150	167	111	178	89	185	74	189	63	192	55	195	49
	152	152	168	112	180	90	188	75	192	64	195	56	197	49
2000	154	154	171	114	182	91	190	76	195	65	197	56	200	50
	156	156	173	116	184	92	191	76	196	65	200	57	202	51
	158	158	176	117	186	93	193	77	198	66	202	58	205	51
	160	160	178	118	189	94	196	78	201	67	204	58	207	52
2100	162	162	180	120	191	95	198	79	203	68	207	59	210	52
	163	163	182	121	193	97	200	80	206	69	210	60	212	53
	165	165	184	123	196	98	203	81	208	69	212	61	215	54
	167	167	186	124	198	99	205	82	210	70	214	61	217	54
2200	169	169	189	126	200	100	207	83	213	71	217	62	220	55
	171	171	191	127	202	101	210	84	215	72	220	63	222	56
	173	173	193	128	204	102	212	85	218	73	222	63	225	56
	175	175	195	130	207	103	214	86	220	73	224	64	227	57
2300	177	177	197	131	209	105	217	87	222	74	227	65	230	57
	179	179	199	133	212	106	219	88	225	75	229	66	232	58
	181	181	202	134	214	107	222	89	228	76	232	66	235	59
	182	182	204	136	216	108	224	90	230	77	234	67	237	59
2400	185	185	206	137	218	109	226	91	232	77	236	68	240	60
	186	186	208	139	220	110	229	92	235	78	239	68	242	61
	188	188	210	140	222	111	231	93	237	79	242	69	245	61
	190	190	212	141	225	112	233	94	240	80	244	70	247	62
2500	192	192	214	143	228	114	236	95	242	81	246	70	250	62
2600	200	200	222	148	236	118	245	99	249	83	255	73	260	65
2700	208	208	231	154	244	122	252	101	261	87	266	76	268	67
2800	215	215	240	160	254	127	262	105	270	90	273	78	280	70
2900	223	223	247	165	262	131	272	109	279	93	283	81	288	72
3000	231	231	253	170	274	137	282	113	291	97	294	84	300	75
3100	238	238	265	177	280	140	292	117	300	100	307	87	318	77
3200	246	246	273	182	290	145	300	120	309	103	314	90	320	80
3300	254	254	282	188	300	150	310	124	318	106	322	92	328	82
3400	261	261	291	194	308	154	320	128	327	109	332	95	340	85
3500	269	269	300	200	318	159	330	132	336	112	343	98	348	87

If this diet does not produce a state of ketosis, it may be necessary to reduce the carbohydrate by 10 Gm. and then 5 Gm. more, increasing the fat to keep the total calories at the same figure. The fatty acid to glucose ratio of the diet calculated for Day 3 above is obtained in the following manner:

$$\frac{\text{Fatty acids}}{\text{Available glucose}} = \frac{0.46\ P + 0.9\ F}{0.58\ P + 0.1\ F + 1.0\ C}$$

$$= \frac{0.46(50) + 0.9(242)}{0.58(50) + 0.1(242) + 1.0\ (30)}$$

$$= \frac{23 + 218}{29 + \ 24 + 30} = \frac{241}{83}$$

or approximately 3 to 1

The calculation of this ratio is not necessary if the diet is planned as described above and if the urine is tested for diacetic acid. If the urine test is negative, one must further decrease the carbohydrate and correspondingly increase the fat.

If the desired ratio of fatty acids to glucose has been determined one can very easily calculate the diet by using the table on page 416. The caloric and protein requirements are calculated as usual. The number of calories required is located on the table and the desired ratio selected to furnish this number of calories. The amount of fat is indicated in the first column and the amount of carbohydrate and protein in the second. The daily carbohydrate intake is obtained by subtracting the protein required from the totals listed in the column marked C + P.

Planning the Daily Diet. This diet is one of the most difficult of all the special diets to make palatable. The high-fat content together with the low carbohydrate and protein allowed taxes the imagination to make attractive and acceptable meals.

KETOGENIC DIET

General rules:

The diet must be weighed in order to insure intake of foods at the proper level.

It is necessary to divide the diet equally in three meals in order to maintain a constant ketosis.

Because of the high-fat prescription, it is advisable and in most cases necessary to include cream, preferably 40 per cent cream, in every menu. The cream may be used with cocoa shells and saccharin for a beverage or it may be used in frozen desserts, with the vegetables allowed, or combined with egg for custard.

Bran wafers with little if any food value are justified in this diet as they add bulk and also serve as a vehicle for some of the butter.

Saccharin may be used as a sweetening agent.

Clear broth without fat and broth made from bouillon cubes may be used in moderate amounts. Some of the butter may be added to the broth.

Water retention is minimized if the sodium chloride intake is maintained at not more than 2 to 3 Gm. daily.
Fluids are usually restricted to 600 cc. or less each day.

Foods to emphasize:

All fats: butter, cream, bacon, salad oils, peanut butter
Meat, eggs, cheese — within the limits of the protein prescription

Foods to avoid:

Bread and cereals
Desserts as cake, cookies, pie, pastries
Sweets as candy, sugar, jelly, preserves
Vegetables and fruits which are high in carbohydrate

The following type diet is suitable for the prescription which was calculated on page 415. Type diets must be planned individually for each patient to meet the levels stipulated in the prescription.

TYPE DIET *

	Measure	Weight Gm.	C Gm.	P Gm.	F Gm.
Breakfast					
Eggs, whole	2	100	..	13	12
Bacon, cooked	2 slices	20	..	2	14
Butter	5 teaspoons	25	..	..	20
Cream, 35 per cent	½ cup	100	3	2	35
Fruit, 9 per cent		80	7	1	..
			10	18	81
Luncheon or supper					
Medium fat meat	1½ ounces	45	..	12	8
Vegetables, 3 per cent	1 cup, approx.	200	6	4	..
Mayonnaise	1 tablespoon	15	..	..	12
Cream, 35 per cent	½ cup	120	4	2	42
Butter	5 teaspoons	25	..	..	20
			10	18	82
Dinner					
Medium fat meat	1½ ounces	45	..	12	8
Vegetables, 3 per cent	½ cup	100	3	2	..
Cream, 35 per cent	½ cup	120	4	2	42
Butter	5 teaspoons	25	..	..	20
Mayonnaise	1 tablespoon	15	..	..	12
Fruit, 6 per cent		60	4	..	..
			11	16	82
Totals for the day	....	....	31	52	245

* Values for nutrients obtained from Table II, Appendix, page 716.

SAMPLE MENU FOR THE TYPE DIET ON PAGE 419

(All food must be weighed)

	Gm.	
Breakfast		
Grapefruit — 6 to 8 slices	80	
Bacon, cooked — 2 slices	20	
Scrambled eggs — 2		
Cellu bran wafers — 2		
Butter — 5 teaspoons	25	Use part in scrambled eggs and part with bran wafers
Cream — ½ cup scant	100	Use part in scrambled eggs
Luncheon or supper		
Lamb chop, medium done — 1 chop	45	
Cabbage — ⅔ cup	100	
Sliced tomato — 1 whole, medium	100	
Mayonnaise — 1 tablespoon	15	
Butter — 5 teaspoons	25	Use on cabbage, lamb chop, and bran wafers
Cream — ½ cup	120	Sweeten with saccharin and flavor with cocoa shells and vanilla
Bran wafers — 2		
Dinner		
Beef sirloin	45	
Lettuce and cucumber	100	
Mayonnaise — 1 tablespoon	15	
Strawberry ice cream		
Cream, whipped	120	
Crushed fresh berries	60	
Saccharin to sweeten		
Butter — 5 teaspoons	25	Use on steak and bran wafers
Bran wafers — 2		

Progression of the Diet. If, after having produced ketosis by the above method, the patient shows a loss of weight, the calories should be increased, the ratio of ketogenic to antiketogenic factors remaining the same. In making such an increase, it is best not to increase the protein but to add fat and carbohydrate in the proportion of 5 : 1.

The patient is kept on the ketogenic diet with a resultant reduction in the number of epileptiform seizures, especially if they have

been of the momentary type (petit mal). A marked improvement will be seen in the child's irritability, mental condition, and general demeanor. It is well to continue the diet for a period of from six months to a year after the seizures are entirely overcome. A gradual return to the normal diet is accomplished by a monthly increase of 5 Gm. of carbohydrates and of the same amount of protein every third month, reducing the fat in proportion if the child is gaining weight properly. The protein may be increased to 2 Gm. per kilogram of body weight.

If the convulsive seizures persist for a month or six weeks in spite of ketosis, a period of absolute starvation of from seven to ten days may be instituted. During the fast, only the juice of two oranges daily is given, and the patient is urged to drink plenty of water. The diet prescription is then gradually resumed.

Every patient who receives a ketogenic diet should be given supplementary vitamins and mineral salts to avoid nutritional deficiences. It has been suggested that part of the fat may be taken as cod liver oil.

Other Uses for the Ketogenic Diet. The diet has been used with varying success in the treatment of certain types of migraine, and occasionally has been of benefit to the patient with asthma. Formerly, the ketogenic diet was used in the treatment of certain types of kidney infections such as pyelitis and kidney abscesses but the sulfa drugs have replaced the dietary treatment to a very large extent.

SUMMARY

Epilepsy is a nervous disease characterized by seizures, convulsions, and loss of consciousness. Its cause is unknown. The ketogenic (high fat) diet is used in the treatment of this disease.

The purpose of the diet is to produce ketosis and to nourish the patient without causing overnutrition in the adult or undernutrition in the child. These objectives are achieved by allowing (1) energy intake sufficient for adults but no surplus; adequate for children to meet the growth quota; (2) protein intake low to average — $\frac{2}{3}$ Gm. for adults in the beginning; 1 Gm. per kilogram of body weight for children unless growth is not satisfactory, in which case the protein is increased to $1\frac{1}{2}$ Gm. per kilogram of body weight; (3) 600 cc.

or less of fluids; (4) low carbohydrate intake and high fat intake, the fatty acid-glucose ratio being adjusted to the individual according to the degree of ketosis desired.

The diet is changed from the normal to the ketogenic by increasing the fats and decreasing the carbohydrates gradually in order to avoid nausea and vomiting.

PROJECT

Plan a ketogenic diet for a child weighing 65 pounds. Use 15 Gm. of carbohydrate daily.

REVIEW QUESTIONS

1. What is meant by a ketogenic diet?
2. For what diseases or symptoms is the ketogenic diet a valuable part of the treatment?
3. List the modifications of the regular diet which are necessary in order to obtain a ketogenic diet.
4. What foods are stressed in the planning of ketogenic diets? Which ones are restricted?
5. What factors are most likely to be deficient in the ketogenic diet? How may such deficiencies be corrected?
6. Outline the instructions you would give to the mother of an epileptic child for careful control of the diet.

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CHAPTER XXXI

Diet in Diseases of the Circulatory System

Role of Nutrition in Cardiac Efficiency. There is no doubt about the importance of good nutrition in the normal functioning of the heart. The markedly malnourished peoples of the world frequently exhibit manifestations of cardiac impairment such as dyspnea and palpitation on exertion, enlargement of the heart, and systolic murmurs. Inadequate vitamin B_1 has been shown to be especially responsible for these conditions which are common manifestations of beriberi, the thiamine deficiency disease. Following World War I many of the starved people of central Europe showed evidences of cardiac deficiency; these, however, were generally corrected with an improvement in the state of nutrition.

Cardiac Disease as a Menace to Health. Cardiac disease ranks first as a cause of death, and so becomes a health problem of the greatest magnitude. No age is free from the danger of attacks upon the heart. Heart weaknesses develop after certain diseases of childhood, as well as during rapid growth in the adolescent period. Heart damage is one of the penalties for overindulgence during middle life, and senile heart disease is a common accompaniment of old age. The avoidance of obesity together with the attainment of a well ordered life which keeps the mental and emotional stresses and strains at a minimum are good prophylactic measures.

Pathological Conditions. The diseases of the heart may be roughly classified as functional and organic, and the parts affected are (1) the pericardium or outer covering of the organ, (2) the endocardium, or membranes lining the heart, and (3) the myocardium, or the heart muscle. As a rule, acute infections attack the pericardium and endocardium, while chronic heart disturbances usually involve the myocardium and valves. Thus a disease of the heart may be pericarditis, endocarditis, or myocarditis (myocardial failure).

There are progressive stages in diseases of the heart. During the first stage nearly normal circulation is maintained through the efforts of the organ itself by enlargement of the heart and an acceleration of the pulse rate. This is a period of "compensation." In the second stage, or stage of moderate compensation, the heart is beginning to labor, the myocardium and valves are affected to the extent that they cannot assume the entire burden of maintaining normal circulation and some definite adjustment of diet must be made to lighten the load and give some rest to the organ. In the third stage, or stage of decompensation, the disturbance has become more or less chronic in character, and every effort must be made to prevent further damage to the organ by relieving the strain.

Because the heart, blood vessels, and the kidneys are so closely associated in their work in the body, it is difficult to consider one without the other. When the tissues of the kidneys become diseased, there may be changes in the blood vessels of those organs which in turn may bring about a change not only in the heart functions but in the entire vascular system. Infections, obesity, edema, hypertension, and constipation all complicate and make the treatment of diseases of the heart more difficult. Moreover, the heart is located close to several other organs, especially the stomach and intestines, and distention taking place in either of these organs is likely to press against and irritate the heart.

Whenever obesity occurs it is absolutely essential that reduction of weight be brought about. McLester[1] states four reasons for this: (1) excessive weight results in an imbalance between the body mass and strength of the heart muscle; (2) deposits of fat in the myocardium decrease the efficiency of the heart; (3) abdominal fat interferes with movements of the diaphragm and free action of the heart; and (4) arteriosclerosis is a common successor to obesity and a serious handicap to the heart.

Modifications of the Diet. There are two vital objectives in the dietary management of cardiac diseases, namely, (1) the maintenance of good nutrition in an attempt to restore the heart as much as possible, and (2) a maximum of rest for the organ to avoid further damage. Both objectives can be realized if one considers not only the essentials needed for good nutrition but also the amount, choice, and consistency of food as well as the fluid and salt intake. The

following modifications of the diet are necessary to achieve these goals:

Energy. One of the most important factors to consider is that of caloric intake. It is well known that marked improvement usually follows reduction of weight if the patient is obese, but it is less well recognized that a mild degree of undernutrition for those who are of normal weight may also prove to be beneficial. The importance of giving a diet low in calories is emphasized by Proger and Magendantz of Boston[2], and Masters and associates of New York.[3] Their results indicate a slowing of the heart rate, lowering of blood pressure, and improvement of cardiac efficiency. These doctors recommend very low calorie diets — 400 to 600 calories — during acute illness, with gradual increases to 1200 calories. When a mild degree of undernutrition (4 or 5 pounds below normal weight) has been attained it is advisable to give a maintenance diet of about 30 to 35 calories per kilogram of body weight or about 1400 to 2100 calories per day.

Protein. A protein intake of 1 Gm. per kilogram of body weight or about 60 to 70 Gm. daily is satisfactory for maintenance of body tissues. Lower protein levels are inadvisable for long periods of time since they would lead ultimately to depletion of tissue and serum protein with a consequent tendency to edema. On the other hand, excessive proteins lead to undue stimulation of the metabolism and should be avoided.

Carbohydrate. An abundance of easily digested and readily assimilated carbohydrate has been found to be beneficial to the injured myocardium. Hence, the liberal use of glucose, Karo syrup, honey, plain sugar candy, and malted products as dextrimaltose, and malted milk should be encouraged.

Fat. Sufficient fat is included to make up the caloric requirements, but it must be in easily digestible form, such as egg yolk, butter, and cream. In the case of gastric retention it is advisable to reduce the fat in the larger meals and give it in some form at the intermediate feedings. This is because fat exerts a depressing effect on the gastric secretions, slowing down the emptying time of the stomach.

Sodium Chloride. The importance of salt restriction in the presence of edema cannot be overemphasized. The effects of various

amounts of salt on the production of edema in cardiac disease have been studied by Dr. Schroeder[4] of New York who says: "By changing the quantity of salt in the diet, without varying the food, the intake of fluids, or the patient's activity, the weight and the amount of edema could be controlled at will." Schroeder suggests that it is sometimes necessary to reduce the salt intake to 1 Gm. or even 0.5 Gm. daily in order to bring about loss of edema fluid. Diets containing such small amounts of salt must be carefully calculated for sodium chloride. They will be inadequate because it is impossible to include sufficient quantities of milk and meat, and consequently they should be used only temporarily to relieve edema. An intake of not more than 2 Gm. sodium chloride daily is usually a sufficient restriction, and such diets are entirely adequate when carefully planned. If food is cooked without salt, the amount of salt in the daily diet will be 2 Gm. or less, providing the intake of milk is limited to 1 pint daily.

Fluid. A moderate intake of fluid is advisable in most cardiac disturbances. When edema is a complication, a restriction of fluid from 800 cc. to 1500 cc. per day is usually recommended. Milk, fruit juices, and soups as well as water should be counted as fluid when tabulations are made of the patient's fluid intake. There is ever increasing evidence that patients may be allowed as much water as they please if their intake of sodium chloride and other sodium salts is very strictly limited (Proger[5] and Schroeder[4]). In other words, edema fluid will not accumulate unless there is sufficient salt to retain the water in the tissues.

Amount of Food. Small amounts of food given at frequent intervals are preferable to large meals since the latter may result in an excessive strain on the heart during digestion. A large amount of bulk should never be given at any one time.

Consistency. The importance of selecting easily digested foods cannot be overemphasized. When decompensation occurs it is especially important that soft, bland, easily digested foods which require little chewing be used. During this stage the patient must not even be permitted to feed himself. When the patient's condition has improved, he may be given foods which are not strained.

Choice of Food. Constipation which must be avoided can be relieved through judicious use of fruits and vegetables and by liberal

inclusion of thiamine. The choice of foods must be restricted to those which are non-distending. Vegetables of the cabbage family, onions, turnips, and dried beans are contraindicated.

Planning the Daily Diet. Marked restrictions of food are necessary during severe decompensation. Maximum rest is fundamental and at this time adequate nutrition is of but secondary importance. During this stage food may be temporarily withheld from the patient or a liquid diet prepared without salt may be used (see Liquid Diet on page 246). The Karell diet which is primarily a regimen of undernutrition allows 800 cc. of milk daily in four feedings of 200 cc. each, administered at 8 A.M., 12 M., 4 P.M., and 8 P.M. This routine is used for three or four days, and is then modified to include other easily digested foods as toast, eggs, cream soups, and fruit.

The salt-poor soft diet may be used as soon as the condition of the patient permits and leads gradually up to the salt-poor regular diet.

SALT POOR SOFT DIET

(For Cardiac Decompensation)

Include these foods daily:

2 cups milk; no more than that
1 serving minced or ground meat, fish, or poultry (3 ounces)
2 eggs, or 1 egg and a substitute of soft cheese, ground meat, or fish
2 servings strained fruit — one to be citrus or tomato
1 potato
2 servings strained vegetables
1 serving strained whole-grain cereal
3 teaspoons butter
Additional carbohydrate from glucose, jelly, honey, etc.

General rules:

All foods must be prepared and eaten without salt. The diet will then contain not more than 2 Gm. sodium chloride daily.

Foods must be soft and easy to digest. A complete list of foods allowed may be obtained by consulting the soft diet on page 247.

Carbohydrate foods, especially glucose and jelly, should be used liberally.

In place of salt-poor bread one may use matzoth, soda crackers, or plain unsalted triscuits.

Whenever it is desirable to restrict calories, the principles of this diet may be applied to the low-calorie diets on page 303.

Food to avoid:

Those containing much salt; see list on page 429.

TYPE DIET	SAMPLE MENU
Breakfast	
Strained fruit or juice	Orange juice with added glucose*
Egg	Soft cooked egg
Unsalted toast	Buttered toast
Unsalted butter	
Beverage	Weak coffee — 1 cup only
Midmorning	
Strained or fine cereal	Strained wholewheat cereal
Milk and sugar	Milk and sugar
Luncheon or supper	
Egg, cottage cheese, minced meat, fish, or poultry	Minced chicken
Strained vegetable	Strained asparagus
Unsalted bread and butter	Bread and butter
Jelly	Grape jelly
Beverage	Milk —1 glass
Midafternoon	
Dessert	Frozen custard
Dinner	
Minced meat, fish, or poultry	Ground beef patty
Potato	Baked potato without skin
Strained vegetable	Strained carrots
Unsalted bread	Bread — 1 slice
Unsalted butter	Butter for bread and potato
Jelly	Currant jelly
Evening nourishment	
Strained fruit	Applesauce
Milk	Milk — 1 glass only

* Glucose may be purchased very inexpensibly at grocery stores under various trade names such as Dyno, Cerelose.

The cardiac patient should not be kept on a salt-poor soft diet longer than necessary, for, at best, it is not a very interesting fare. Morale can sometimes be greatly improved with judicious additions of pleasing foods. The regular diet for a patient with cardiac disease is not unlike the regular diet for other patients. However, all foods must continue to be prepared without salt until the patient is edema free. The choice of foods is especially important since no strongly flavored vegetables, fried foods, or foods slow of digestion should be permitted, nor should the amounts of food be too liberal.

SALT POOR REGULAR DIET

Include these foods daily:

2 cups milk; no more than that
1 serving (3 ounces) meat, fish, or poultry
2 eggs, or 1 egg and a substitute of soft cheese, poultry, or fish
1 potato
2 servings vegetable — one to be raw
2 servings fruit — one to be citrus or tomato
1 serving whole-grain cereal
3 teaspoons butter
Other foods to provide adequate calories

General rules:

All foods must be prepared and eaten without salt.

Jelly may be used with salt-poor bread to improve the palatability of the latter.

Lemon juice, bay leaf, sweet butter or cream, mace, pepper, and tomato may be used for seasoning.

Most substitutes for salt contain sodium (sodium formate or sodium malate) and cannot be used on a salt-poor diet. Potassium chloride is sometimes used as a salt substitute but most patients object to its unpleasant taste.

Foods to avoid:

Bread, unless made without salt

Dry cereals except shredded wheat, puffed wheat, or puffed rice

Canned, salted, or smoked meats, poultry, or fish; as bacon, chicken, chipped beef, corned beef, ham, herring, salmon, sardines, salt pork, sausage, tuna fish

Canned vegetables, except those canned without salt

Cheese, except cream cheese or unsalted cottage cheese

Crackers, except soda crackers

Cakes and cookies which contain baking soda

Salted nuts or foods containing them

Bouillon cubes, catsup, caviar, olives, pickles, relishes, salt butter, celery salt, onion salt, sauerkraut

Strongly flavored vegetables as broccoli, Brussels sprouts, cabbage, cauliflower, cucumber, kohlrabi, onions, peppers, radishes, rutabagas, turnips

Fried foods, rich desserts and pastries

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Stewed prunes
Cereal or egg	Shredded wheat with milk
Unsalted bread	Toast with butter
Unsalted butter	
Jelly	Apple jelly
Beverage	Coffee — 1 cup only
Luncheon or supper	
Egg, cottage or cream cheese, meat, fish, or poultry	Buttered spinach
Potato or other starchy food	Baked potato
Salad with salt-poor dressing	Cottage cheese on romaine with French dressing
Unsalted bread with unsalted butter	Bread with butter
Dessert	Spanish cream
Beverage	Milk — 1 glass
Dinner	
Meat, fish, or poultry	Roast chicken
Potato	Mashed potato
Vegetable	Stewed tomatoes
Bread or crackers	Bread with butter
Butter	
Fruit	Fresh fruit cup with mint ice
Beverage	Tea with lemon and sugar

Instructions to the Patient. There are a few simple rules which should be impressed upon patients suffering from a disease in which the muscles of the heart have become weakened. First, meals should be kept small, simple, and easily digestible — overeating, and eating foods known not to agree, should be avoided. Second, foods which are high in salt content should be omitted if there is any tendency to edema. Third, rest before and after meals is of first importance. Exercise should not be permitted after eating, at which time the heart has work enough to do without adding to its burden. Fourth, alcoholic beverages and tobacco which have a stimulating effect upon the body should be studiously avoided except when expressly allowed by the physician. Fifth, worry and nervous strain of any kind should be avoided as far as possible, because they increase blood pressure and add work to the laboring heart. It is especially important that meal times be quiet and happy.

HYPERTENSION

Hypertension, a complex disturbance of unknown etiology, may be defined as "an elevation of the blood pressure above normal." The disturbances may occur at any age, but persons of middle age or beyond seem more prone to develop high blood pressure than younger people. Arteriosclerosis, kidney and heart disturbances may accompany the rise in blood pressure; and obesity is one of the commonest of the predisposing factors, though there are other diseases which may be closely associated with it. Infections increase the disturbances — diseased tonsils, bad teeth, chronic sinus trouble — all may add to the progress of the disease, which may be temporary or permanent.

Arteriosclerosis brings about a thickening of the blood vessels and lessens the space through which the blood has to pass. This condition not only causes a rise in blood pressure but interferes with the blood supply reaching the kidneys, and so these organs are affected. The heart, in turn, is given additional work pumping blood through the restricted passages. Thus it is not a question of blood vessels alone which must be considered in the treatment of hypertension, but of the heart and kidneys as well.

Dietary Considerations. The importance of a "calm, philosophic outlook on life" has been emphasized (Allen and Adson[6]). There is little evidence that diet influences hypertension one way or the other. No restriction of protein or salt below normal needs is necessary. However, reduction in weight is essential for obese individuals since it is well known that the blood pressure can be favorably influenced by a weight loss. The best rule which the patient with hypertension can observe relative to the diet used is to practice moderation in the amounts of food eaten, amounts of seasoning used, and quantities of stimulating beverages consumed. Of course, if there are accompanying heart or kidney disturbances the diet pattern should be in accord with that prescribed for those diseases.

SUMMARY

1. The cardinal principle in the treatment of cardiac disease is that of rest. To that end the diet should be one which is easily digested. Feedings should be small and at frequent intervals.

2. In cases of obesity, reduction of weight should be brought about, but this must be done under strict supervision of the physician.

3. Protein allowances should be sufficient for normal nutrition since a prolonged deficiency will merely aggravate any existing edema.

4. Because of the beneficial effect of carbohydrate it is advisable to increase the intake of this nutrient.

5. In the presence of edema the salt intake should be limited to 2 Gm. or less daily. Fluids are customarily restricted to 1500 cc. or less daily in that event.

6. Obesity is frequently the factor requiring special modification in dietary treatment of hypertension.

7. Food in itself does not influence hypertension one way or the other. The best rule for the patient to observe is to eat a normal diet, practicing moderation in amounts of food eaten, and amounts of seasonings used.

PROJECT

Plan a salt-poor regular diet. Calculate the sodium and chloride contents of this diet.

REVIEW QUESTIONS

1. What are the three layers of the heart which may be diseased? What types of disease may occur in each?
2. What is meant by compensation and decompensation? How does each affect the dietary treatment?
3. Give three reasons why obesity is a serious problem in circulatory disease.
4. What is the primary objective in treatment of cardiac disease?
5. List six principles of dietary treatment for cardiac disease?
6. Enumerate the differences between a regular and a soft salt-poor diet. When is each used?
7. What is the Karell diet? When is it used?
8. What dietary modification is advisable in hypertension?

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CHAPTER XXXII

Diet in Diseases of the Kidney

Functions of the Kidney. The kidneys are highly selective filters and excretory organs the chief function of which is the maintenance of a constant blood composition. Their work is so closely related to the heart and blood vessels that any damage to one system will sooner or later affect the other. By means of the cardiovascular system the waste products resulting from the metabolic processes are transported to the kidneys for excretion in the urine.

The kidney contains several million units called nephrons which are responsible for the collection of wastes from the blood. Each nephron consists of (1) a glomerulus, or tuft of capillaries which collects the end products of metabolism from the blood, and (2) a long tubule which receives the fluid and the wastes from the glomerulus. Glucose and part of the water and sodium chloride which are of value to the body are reabsorbed from the tubules, while the wastes and surplus water and sodium chloride go into the pelvis of the kidney by means of larger collecting tubules. This fluid waste is then retained in the bladder and finally eliminated from the body as urine.

Acid and basic mineral salts and nitrogenous end products of protein metabolism such as urea, uric acid, creatinine, and ammonium salts are the chief solid wastes eliminated by the kidney. They constitute about 5 per cent of the urine, the rest being water which holds these materials in solution. Urea is the chief excretory product of nitrogen metabolism. The urinary volume is dependent upon the fluid intake and the losses from the lungs and skin. For the constituents of normal urine see Table IX in the Appendix, page 739.

Disturbances of Kidney Function. Nephritis is a disturbance of the kidneys which may be roughly defined as "an inflammation or degeneration of the organ involving the parenchyma and interstitial tissues of the organs." If there is interference with the normal

functioning of the kidneys, waste products accumulate in the blood so that eventual acidosis and uremia occur if the condition is serious enough. Edema may be initiated if the proteins in the circulation and in the tissues have been depleted because of inadequate protein intake or excessive protein loss in the urine. The inability of the kidney to excrete normal concentrations of the mineral salts leads to an accumulation of these salts in the body. This may, in turn, aggravate the edema by upsetting the usual mineral-water balance systems of the body.

There are several classifications of nephritis, although in clinical practice it is usually rarely that one finds injury confined to one part of the nephron only. From the dietetic standpoint we will consider (1) the "true nephritis" or glomerulonephritis which affects the glomeruli, and (2) nephrosis which involves the tubules.

NEPHRITIS

Characteristics of Glomerulonephritis. Glomerulonephritis is primarily confined to the glomeruli and is usually characterized by hematuria, some nitrogen retention, varying elevation of blood pressure, and proteinuria. It may be of short duration or it may become chronic. It is frequently a sequel to infections such as scarlet fever, tonsillitis, pneumonia, and respiratory infections. It occurs most frequently in children and young adults. This illness need not be permanently damaging, but if not properly treated in the acute stage it progresses to the chronic stage and gradually progressive involvement.

The patient with nephritis has an essentially normal basal metabolism, unless he has been markedly malnourished for a long period of time either through lack of sufficient food or through inadequate absorption because of vomiting in which case there may be a lowering of the basal metabolic rate. The utilization of carbohydrates and fats is in no way impaired.

The influence of various levels of protein intake on the course of nephritis has long been a subject for heated discussions by medical men. It was the practice for many decades to severely restrict the use of protein on the basis that protein foods increased the work of the kidneys and consequently produced further damage. It then became evident that the rigid restriction of protein was fundamen-

tally unsound since a certain amount of nitrogen metabolism and excretion occurs even under basal conditions. There are three factors which require consideration in the protein metabolism of nephritis. Not only is there the usual daily wear and tear of tissues, but superimposed upon this quota is the toxic destruction of protein which occurs especially in acute stages of the disease, and also a variable loss of protein in the urine. If the diet, then, is low in protein or contains protein of inadequate quality the body tissues will be consumed to a greater or lesser degree, and the patient's body protein becomes correspondingly depleted. The end result of the low protein diet is a needless drain on the body tissues and an accompanying reduction in the serum proteins so that edema occurs and the patient becomes progressively weaker. It has been found that those patients who have had allowances of protein liberal enough to cover all of their needs have remained in better health for longer periods of time than those who have been severely restricted. While the edema which occurs in nephritis is usually occasioned by inadequate intake of proteins to cover all the body needs, it has been found that excessive intake of sodium may be a factor in the aggravation of such an edema.

Modifications of the Diet. The objectives for dietary management in the treatment of nephritis are several: (1) to maintain the patient in a state of good nutrition since such a condition affords better resistance as well as a sense of well-being; (2) to prevent edema; (3) to avoid harm from unnecessary limitations; and (4) to spare the damaged kidneys.

Protein. The protein level should be adequate to cover the daily wear and tear of the body, the toxic destruction of protein which occurs in acute stages of nephritis especially, and the loss of protein in the urine. No arbitrary level can be set for the daily intake of protein, for it will depend upon the previous state of nutrition as well as on the amount of protein excretion and protein destruction. Some clinicians advocate a diet containing 1 Gm. of protein per kilogram of body weight plus the amount of protein lost in the urine.[1] For some patients 70 to 80 Gm. of protein may suffice, while those who are malnourished, edematous, and who lose much protein daily may require over 100 Gm. The protein in the diet should be selected largely (at least two thirds) from the complete protein

foods which will be most efficiently utilized and thus entail the least possible work for the kidney. New research indicates that the use of amino acids by oral or parenteral routes may be a boon to the patient with nephritis.

Fat. A normal intake of fat is desirable.

Carbohydrate. Most efficient utilization of protein is possible if the carbohydrate intake is liberal. Sufficient carbohydrate and fat should be supplied for adequate energy so that the protein need not be a source of calories.

Salt. The chief cause of edema in nephritis has been shown to be a protein deficit, but excessive sodium chloride may be a contributing factor. In the presence of edema a salt-poor diet may be used; that is, foods are prepared without the addition of salt, and all salty foods are prohibited. However, if the lack of salt results in serious interference with the appetite it is advisable to allow some salt in food preparation so that adequate quantities of foods will be consumed to maintain good nutrition. Malnutrition resulting from inadequate intake of protein and other nutrients will further aggravate an edema.

Fluids. Agreement is not general on the amount of fluid to be used. There are those who recommend that fluids be forced even though edema is present since water itself is a good diuretic. Others limit fluids to 1200 cc. or so each day. It is seldom necessary to restrict fluids below 1000 cc. per day. Restriction is usually practiced during marked oliguria.

Reaction of the Diet. Sansum and his associates[2] recommend the use of a base-forming diet since the work of the kidney is more difficult if the diet is acid-forming. Such a base-forming diet requires special emphasis on milk, fruits, and vegetables.

Planning the Diet in Acute Nephritis. In acute nephritis the attacks are more or less severe, being accompanied by nausea and vomiting. The urine is scanty and contains casts, albumin, and blood. During the acute stage, the patient must be confined to bed, as absolute rest is an essential part of the treatment. Such attacks are of short duration and the diet need not necessarily fully cover the needs of the body.

When nausea and vomiting occur, all food should be omitted for one or two days, allowing only small amounts of crushed ice or

fruit juices during that time. Milk is usually the first food allowed since it furnishes protein of the best quality as well as other nutrients. Toast with butter, cereals, eggs, and fruit are gradually added until the patient is able to take a complete soft diet. If edema is present the food should be prepared without the addition of salt. The physician may direct that the daily fluid intake be limited to 1200 cc. or even less. As soon as possible the patient should be given a normal diet, or even one in which the protein level is elevated to compensate for whatever toxic destruction of tissue proteins has occurred.

Planning the Diet in Chronic Nehpritis. The following diet which contains approximately 100 Gm. of protein may be used for the patient with chronic nephritis.

HIGH PROTEIN DIET

Include these foods daily:

1 quart milk
3 eggs
1 ounce cheese, or a substitute of milk, eggs, meat, poultry, or fish
1 serving (3 to 4 ounces) meat, fish, or poultry
1 serving whole-grain cereal
2 servings fruit — one to be citrus or tomato
2 servings vegetable — one to be raw
1 potato in addition to the two vegetables
3 teaspoons butter
Other foods to provide adequate calories

General rules:

Complete protein foods should be emphasized in this diet. Those of best quality include milk, cheese, eggs, and meat products.

It is advisable to limit the use of incomplete protein foods when this diet is intended for a patient with nephritis, since those foods which do not contain sufficient quantities of the essential amino acids are less efficiently and completely utilized by the body.

Dried milk and egg white are effective reinforcing agents whenever it is difficult for the patient to eat the amounts of protein foods listed above. See recipes for high-protein beverages, pages 585–7.

Whenever a salt-poor diet is indicated the regulations listed for such diets on page 429 should be observed.

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Half grapefruit
Cereal with milk and sugar	Pettijohns with milk and sugar
Eggs, two	Fried eggs
Bread, wholewheat	Wholewheat toast
Butter	Butter
Beverage	Cocoa
Midmorning	
Milk — 1 glass	Milk — 1 glass
Luncheon or supper	
Cheese or substitute of egg, meat, fish, or poultry	Chicken soufflé
Potato, macaroni, spaghetti, noodles, or vegetable	Buttered green beans
Salad with dressing	Shredded carrot and raisin salad
Bread with butter	Wholewheat roll and butter
Fruit	Fresh peaches
Beverage	Milk
Midafternoon	
Eggnog	Chocolate eggnog
Dinner	
Meat, fish, or poultry	Broiled trout
Potato	Creamed potato
Vegetable	Beet greens
Bread with butter	Rye bread and butter
Dessert	Apple betty with hard sauce
Beverage	Tea with lemon

NEPHROSIS

Characteristics of Nephrosis. True nephrosis is confined to the tubules of the kidney but only rarely does it occur without associated glomerulonephritis. Like glomerulonephritis it is characterized by edema and by proteinuria, although in nephrosis these conditions are present to an even more marked degree. The serum proteins are more seriously depleted than in glomerulonephritis, and their regeneration is a much slower process. Nephrosis differs from nephritis in that hematuria, high blood pressure, and nitrogen retention do not occur. The blood lipides, cholesterol in particular, are increased. Contrary to early reports there is no deviation of the basal metabolism from the normal if the rate is based on the patient's true body weight.

Modifications of the Daily Diet. A high protein diet for the treatment of nephrosis was first suggested by Dr. Epstein[3] of Mt. Sinai Hospital in New York City. He gave 120 to 240 Gm. of protein daily but restricted the fat to 40 Gm. or less, in an effort to lower the blood lipides. Experimental work has shown that the level of fat in the diet for patients with nephrosis has little if any effect on the blood lipides.[4] Since it is difficult to plan palatable diets which are high in protein but low in fat it is desirable to include sufficient fat to provide a pleasing diet.

Protein. A high protein intake, 1½ to 3 Gm. per kilogram of body weight, is recommended for patients with nephrosis. These levels are necessary if one expects to maintain existing body tissues, compensate for protein losses in the urine, and rebuild tissue and blood proteins. Lest one become discouraged at the slowness with which serum and tissue proteins are rebuilt, one should realize that true nephrotics do show improvement if high-protein diets are eaten for a long enough period of time. A high retention of nitrogen for tissue rebuilding is a common finding in these patients. Subjective improvement including loss of edema fluid frequently occurs before there is any noticeable increase in the serum protein level.

Energy. The caloric intake sometimes needs to be greater than normal. This is especially true for the patient who may have been eating poorly for a long period of time. Not infrequently one fails to realize the serious loss of body tissue which may have occurred because edema so effectively masks the true state of nutrition. Unless the caloric intake is great enough to supply the body's energy needs, effective tissue regeneration will not take place.

Salt. Sodium chloride is usually limited in the diet for patients with edema. However, such limitation means that not more than 1 pint of milk should be taken daily because of the high sodium chloride content of milk. Moreover, meats and eggs are so unpalatable without salt that many patients refuse to take them at all. The use of greater quantities of milk, or of small amounts of salt in the preparation of the food, is certainly preferable to the occurrence of malnutrition which may follow refusal to eat a diet rigidly restricted in salt.

Planning the Daily Diet for the Nephrosis Patient. Patients with

nephrosis usually have poor appetites. Emphasis should be placed on the planning and preparation of palatable, varied, and easily digested meals. The high-protein diet outlined for nephritis on page 438 may be used for nephrosis as well. If more than 100 Gm. of protein is desired daily, the diet should be supplemented with high protein beverages prepared with milk, egg white, dried milk, and fruit juices. The choice of foods for the young child should be that suitable for the child's age; the amounts of foods for the child are also regulated according to his requirements.

UREMIA

The symptoms of uremia appear when kidney function has decreased to such an extent that waste products are no longer excreted from the body. The wastes accumulate in the body and the patient may complain of headache, nausea, and vomiting. Drowsiness, lethargy, and finally coma take place. The blood studies indicate marked nitrogen retention. There is usually an accompanying acidosis and dehydration.

Planning the Daily Diet. During a period of marked nitrogen retention it may be desirable to restrict the protein intake to about 50 Gm. daily. Careful emphasis must be placed on the selection of protein foods of high biological value, and the intake of sufficient carbohydrate to most effectively spare tissue protein. The diet is not intended to be used for long periods of time.

MODERATELY LOW PROTEIN DIET

Include these foods daily:

1 pint milk — no more than that
2 eggs or 1 egg plus 1 small serving (2 ounces) meat, poultry, or fish
1 potato
3 slices bread — no more than that
2 servings whole-grain cereal, macaroni, rice, spaghetti, etc. — no more than that
2 tablespoons butter
2 servings fruit — one to be citrus or tomato
2 servings vegetables in addition to the potato — one to be raw

Foods to avoid:

Beans, dried navy or lima
Cheese except as allowed in place of an egg above

Gelatin
Lentils and dried peas
Nuts
Milk and egg desserts unless used to replace part of those foods above

General rules:

Because edema is usually present the diet is prepared and eaten without salt. Foods which contain much salt are listed on page 429

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Orange juice
Cereal with milk and sugar	Cooked Ralston with milk and sugar
Toast — 1 slice, unsalted	Toast, enriched bread — 1 slice
Butter, unsalted	Butter
Jelly	Grape jelly
Beverage with cream and sugar	Coffee with cream and sugar — 1 cup
Luncheon or supper	
Egg — one	Poached egg on buttered toast
Vegetable	Buttered Swiss chard
Salad with salt-poor dressing	Lettuce and tomato salad with Salt-poor mayonnaise
Bread with butter	
Fruit	Fresh apricots
Milk — 1 glass only	Milk — 1 glass only
Dinner	
Meat, fish, or fowl — 2 ounces	Beef patty, small
Potato with unsalted butter	Baked potato with butter
Vegetables	Parsley buttered carrots
Fruit or dessert as allowed	Fruit salad — grapefruit and pineapple with Fruit salad dressing
Bread with butter	Bread with butter, unsalted — 1 slice
Milk — 1 glass only	Milk — 1 glass only

PYELITIS

Pyelitis is an infection or an inflammation of the pelvis of the kidney and in its acute stage may be accompanied by fever. The ketogenic diet used in the treatment of epilepsy (page 418) gives a decidedly acid reaction and has been used with favorable results

in the treatment of pyelitis because the acids which are produced are definitely bactericidal. However, the sulfa drugs are now so effectively used in treating urinary infections that the ketogenic diet is very seldom necessary. The lack of bulk and the unpalatability of the ketogenic diet make the regimen unsatisfactory for many patients. It should be noted that the acid-ash diet described on page 444 is often used in conjunction with acid medications for the treatment of urinary infections.

KIDNEY STONES

The possibility of dissolving kidney stones (urinary lithiasis) by dietary treatment was suggested by Dr. Higgins[5] of the Cleveland Clinic. His experimental work with rats indicated that the incidence of renal calculi was related to vitamin A deficiency and he applied his findings to the treatment of patients suffering from kidney stones by using a diet high in vitamin A with an acid- or alkaline-ash reaction.

The fundamental purpose of the diet is to adjust the reaction of the urine so that salts are held in solution and precipitation cannot occur. If clinical tests indicate deficiency of vitamin A, the diet should also contain liberal quantities of this factor. It is first necessary to determine the reaction of the urine and the type of calculi which are being formed. When stones are composed of calcium and magnesium phosphates, carbonates, or oxalates and the urine is alkaline in reaction, the high vitamin A acid-ash diet is used. When there are uric acid or cystine calculi in the urine, a high-vitamin A, alkaline-ash diet is used. During the hospital stay an effort is made to vary the diet until the pH of the urine is properly controlled. If the acid-ash diet has been prescribed, an attempt is made to maintain the pH between 4.5 and 5.0. However, if the alkaline-ash diet is prescribed, a pH of 7.6 to 8.0 is to be secured. The patient is then maintained on a diet which will effect a continuous pH at the desired level.

There has been considerable disagreement on the merits of this diet as an agent in dissolving kidney stones or in preventing their formation. Some clinicians have reported remarkable success, while others have failed to obtain any beneficial results.[6]

Planning the Daily Diet. An adaptation of the acid-ash diet used in the Cleveland Clinic by Dr. Higgins is given here.

ACID ASH DIET

Include these foods daily:

Acid-ash foods (minimum amounts)
- 2 servings (6 to 8 ounces) meat, fish, or poultry
- 2 eggs
- 1 serving cereal, preferably whole-grain
- 5 slices wholewheat bread
- 1 serving macaroni, rice, noodles, spaghetti, or corn

Alkaline-ash foods (maximum amounts)
- 1 pint milk
- $\frac{1}{4}$ cup cream
- 2 servings vegetables — one raw and leafy
- 2 servings fruit — one to be orange, grapefruit, or tomato

Concentrated vitamin foods
- 6 brewer's yeast tablets
- 2 tablespoons cod liver oil; or 2 capsules haliver oil before each meal
- 4 tablespoons butter

General rules:

All food should be prepared and eaten without the addition of salt.

The fruits and vegetables should be so selected that they contribute not more than 25 cc. of base daily.

The acid-base value of the diet may be calculated from Tables V and VI in the Appendix (pages 731-2).

The following foods are neutral in reaction and may be used as desired:

Salt-poor butter	Lard
Candy (not chocolate)	Salad oils
Coffee	Sugar
Cornstarch	Tapioca
	Tea

The foods may be seasoned with any of the following:

Bayleaf	Mustard
Unsalted butter	Paprika
Clove	Pepper
Lemon	Pimento
Mace	Tomato

Foods to emphasize:

Bread, especially wholewheat
Cake and cookies
Cereals
Corn
Crackers, unsalted
Cranberries
Eggs
Macaroni, spaghetti, rice
Meat, fish, poultry
Pastries
Peanuts, unsalted
Plums
Prunes
Walnuts

Foods to avoid:

Those high in alkaline ash:

Almonds
Beans, dried lima or dried navy
Beet greens
Chard
Dandelion greens
Figs
Olives
Parsnips
Raisins
Spinach
Dried fruits and vegetables
Molasses

Those high in salt content:

Dry cereals except shredded wheat, puffed wheat, or puffed rice
Canned, salted, or smoked meats, poultry, or fish; as bacon, chicken, chipped beef, corned beef, ham, herring, salmon, sardines, salt pork, sausage, tuna fish
Canned vegetables, except those canned without salt
Cheese, except cream cheese or unsalted cottage cheese
Crackers, except soda crackers
Salted nuts or foods containing them
Bouillon cubes, catsup, caviar, olives, pickles, relishes, salt butter, celery salt, onion salt, sauerkraut

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Grapes
Cereal with milk and sugar	Oatmeal with milk and sugar
Eggs, 2	Scrambled eggs
Bread, wholewheat — 2 slices	Wholewheat toast — 2 slices
Unsalted butter	Unsalted butter — 3 teaspoons
Beverage with cream and sugar	Coffee with cream and sugar
Luncheon or supper	
Meat	Veal chop
Rice or substitute	Steamed rice
Vegetable or salad	Sliced tomatoes
Fruit	Baked apple

ACID ASH DIET *(Continued)*

TYPE DIET	SAMPLE MENU
Wholewheat bread — 2 slices	Wholewheat bread — 2 slices
Unsalted butter	Unsalted butter — 3 teaspoons
Beverage	Milk — 1 glass
Dinner	
Meat	Roast beef
Vegetable	Potato
Vegetable or salad	String beans
Dessert	Tapioca cream pudding
Wholewheat bread — 2 slices	Wholewheat bread — 2 slices
Unsalted butter	Unsalted butter — 3 teaspoons
Beverage	Tea with lemon or cream

Planning the Alkaline-Ash Diet. If stones of the uric acid or cystine type occur, the diet should give an alkaline ash. Such a regimen stresses the use of fruits, vegetables, and milk, while the acid-producing foods such as meats, eggs, and cereals are restricted. The diet must contain all the essentials of good nutrition with particular emphasis on a high intake of vitamin A.

SUMMARY

Nephritis is an inflammatory condition of the kidneys which may be acute or chronic in form, either of which may be accompanied by edema. It is often accompanied with nitrogen retention, while proteinuria is a common finding. Toxic destruction of tissue proteins may occur during the acute stages of the disease. The basal metabolic rate is essentially normal.

In the dietary management of nephritis, the following factors are considered: (1) the protein content varies from normal to high, depending upon the need for replacement of tissue and blood proteins; (2) calories are normal to high as needed to establish and maintain normal weight; (3) salt may be restricted if edema is present; (4) base-forming foods should predominate; (5) fluid intake may be normal or limited; (6) food intake during the first days of the acute illness may be limited if nausea and vomiting occur.

Nephrosis is confined to the tubules and manifests itself by edema, proteinuria, and low serum proteins. The diet must be high in protein, normal to high in calories, and designed to encourage the patient to eat all of the required foods.

A restricted-protein diet may be indicated for the patient who is uremic. Such a diet allows 50 Gm. of protein per day and should not be used for long periods of time.

Various dietary regimens have been used for the treatment of urinary infections. They are all planned on the principle of providing an acid reaction of the urine, the acid being bactericidal in effect. The ketogenic diet and the acid-ash diet with acid medications have both been used with success. However, the sulfa drugs have now replaced the dietary regimens in large part.

The acid-ash diet has been used with success in some clinics for the treatment of urinary lithiasis, where phosphate, carbonate, or oxalate stones were being formed. The diet brings about a lowering of the urinary pH to 4.5 or 5.0 so that the stones are dissolved, and their future formation is avoided. The alkaline-ash diet is used for dissolving the uric acid and cystine stones. Cereals, meats, fish, eggs, cheese, and some nuts are acid in reaction, while fruits, vegetables, milk, and some nuts are alkaline in their end reaction.

PROJECTS

1. Plan a diet for a patient with nephrosis. Include 125 Gm. of protein and 2500 calories. Calculate the sodium and chlorine content of this diet.

2. Plan an alkaline-ash diet. Estimate the amounts of acid ash and alkaline ash contained in this diet, showing the amount of excess alkali therein.

REVIEW QUESTIONS

1. What is meant by a nephron? How does it function?
2. List ten waste products which are eliminated by the kidney?
3. What is nephritis? What are some of the differences between glomerulo-nephritis and nephrosis?
4. Why is the requirement for protein in nephritis and nephrosis apt to be greater than normal?
5. What factors should be stressed in the planning of the diet for a patient with acute nephritis? For one with chronic nephritis?
6. What is the ketogenic diet? When is it used?
7. What is meant by an acid ash? An alkaline ash?
8. When is an acid-ash diet indicated? What is the principle for its use?

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CHAPTER XXXIII

Diet in Anemias

Anemia is a condition in which there is a reduction of the number of red blood cells, or of the quantity of hemoglobin, or both. It results in a decreased ability of the blood to carry oxygen to the tissues. This in turn may bring about skin pallor, weakness, headaches, loss of appetite, gastro-intestinal disturbances, and shortness of breath. Various types of anemia are often accompanied by additional symptoms.

Normal Regeneration of the Blood. The building of the cell framework or stroma must be differentiated from the production of hemoglobin. Red blood cells are produced in the bone marrow. Protein, minerals, and vitamins are essential for their production as is also a special factor for their maturation. The process within the bone marrow is a complex one. We know that the reticular cells (young blood cells) must mature; otherwise they cannot become adult cells. The studies of Castle[1] have established the fact that normal gastric juice supplies an unidentified substance which is called the *intrinsic factor.* This combines with the *extrinsic factor* found in certain foods as muscle meats, eggs, wheat germ, rice polishings, and tomato extract. Both make up what we now call the *anti-anemic substance* or *maturation factor,* which is stored in the liver for use by the bone marrow when needed.

Hemoglobin is a protein which is composed of globin and an organic iron compound, hematin. Liberal stores of protein and of iron for the building of this vital material occur in the body under normal conditions. Iron is very much a one-way substance in that only minute amounts of it are lost from the body once it has been absorbed from the intestine. After the blood cell has completed its life cycle of 40 to 60 days it is broken up by the liver so as to free the iron for the building of new cells. The original source of all body iron is that which occurs in foods. It will be remembered

that in all probability the amount of iron absorbed from the small intestine is relatively small (see Chapter VI).

The values for hemoglobin and red cells may be affected by age, sex, and geographic location. As a rough approximation, the following may be given as normal blood values:

Red blood cell count	4.5 to 5.0 million per cmm.
Hemoglobin	14 to 15 Gm. per 100 cc.
Packed cell volume	45 per cent

Types of Anemia. Numerous classifications for anemias have been proposed. For purposes of dietary discussions, however, it is sufficient to consider the iron-deficiency anemias, and pernicious anemia. In all other types of anemia where interference with the production of red blood cells, or actual destruction of blood occurs, it is necessary to find the causative agent and attempt to overcome it, or minimize its effects, whenever possible. X-ray, radium, bone tumors, cirrhosis of the liver, carcinoma, and leukemias are but a few of the conditions which may interfere with red cell formation by the bone marrow. Disintegration of the blood may be the result of the action of intestinal parasites, hemolytic bacteria, or chemical agents such as coal tar products and sulfonamide compounds. Dietary treatment in these instances can be effective only in its tendency to improve general health.

DEFICIENCY ANEMIAS

Factors in the Causation of Deficiency Anemias. The secondary or nutritional anemias are frequently designated as "hypochromic", which means low color. The chief lack is in the amount of hemoglobin which is present. Such deficiency is usually the result of lack of iron, but occasionally it may occur because of protein deficiency or when the copper intake has been inadequate. A deprivation of vitamin C, absence of thyroid secretion, or chronic infections will also interfere with hemoglobin formation. The hypochromic anemias may be grouped in this fashion depending upon the primary causative factor.

1. Due to blood loss
   a. Accidental hemorrhage
   b. Chronic diseases, as tuberculosis or ulcers, when accompanied by hemorrhage
   c. Menstrual losses

2. Deficiency of iron in the diet during period of growth
    a. Anemias of infancy — rapidly expanding blood volume
    b. Chlorosis — in adolescent girls
    c. Anemias of pregnancy and lactation
3. Inadequate absorption of iron
    a. Diarrhea, as in sprue, pellagra
    b. Lack of acid secretion by the stomach
4. Nutritive deficiencies as protein, and minerals other than iron

Copper and other minerals as cobalt and manganese are, no doubt, essential, but they are required in such minute amounts and are so universally distributed that little thought need be given to them except in the case of infants who may be fed exclusively on milk diets for long periods of time. The role of vitamins in blood building is also important, but at the present time experimental data is somewhat conflicting. Moore and coworkers[2] have found, for example, that the addition of B complex vitamins to the diet did not increase the effectiveness of iron which was fed, whereas earlier workers had attributed much importance to the B vitamins in the prevention of anemia.

The increased demands for blood by hospitals may present special problems to the individual who is a repeated donor.

Modifications of the Diet. The purpose of the diet is to furnish material for restoration of the red blood cell count and the hemoglobin level to normal. If the diet is to be effective, it is important that the type and cause of anemia be determined so that treatment can be directed accordingly.

Iron. Iron is no doubt the most important single nutrient concerned in blood regeneration, while protein is next in importance. There are many difficulties which may be encountered in the absorption of iron. A large part of the iron which occurs in foods is unavailable, because it is present in compounds which are not readily soluble and hence are not easily absorbed. The iron salts are more soluble in acid solution which means that they will probably be absorbed from only the duodenum and a small part of the jejunum. As food passes down into the more alkaline portions of the intestine the unabsorbed iron will be eliminated. When planning diets for anemias it is important to select foods which are known to have a high percentage of available iron. It is difficult to plan a truly high-iron diet since the meals are apt to be very bulky. Regenera-

tion of hemoglobin with dietary iron alone is thus bound to be slow and in chronic anemias a supplement of inorganic iron salts as ferrous sulphate should be prescribed by the physician.

Protein. The diet should be adequate in proteins of high biologic value such as milk, cheese, meat, and eggs. Soy beans constitute a valuable supplement. Whenever there is any evidence of protein insufficiency in the body a daily intake of 100 Gm. or more of protein is advisable.

Other Factors. Anemias are so often accompanied by other deficiencies that a liberal intake of the vitamins, especially B complex and C should be urged. Inadequate dietary levels of calcium and vitamin D also interfere with the absorption and storage of iron. If high-fat diets are given when there is insufficient secretion of bile there may be interference with the absorption of iron as well as the various fat-soluble vitamins.

Selection of Foods. Whipple[3] has made an extensive study on the effectiveness of various foods in regeneration of hemoglobin. His results show that liver of any kind, with the exception of fish livers, is a food *par excellence* for blood building and that foods may be grouped as follows in descending order of potency.

I. Liver (except fish liver), kidney, gizzard
II. Peaches, apricots, prunes
Raisins, apples, grapes
Skeletal meats, sweetbreads, brains
III. Common vegetables
Whole-grain cereals, eggs
Cheese, milk, cream

Planning the Daily Diet. The dietary recommendations which have been proposed for blood donors by the diet therapy committee of the American Dietetic Association under the chairmanship of Miss Turner[4] are very satisfactory for blood regeneration. The pattern given below is adapted from those recommendations.

DIET FOR NUTRITIONAL ANEMIA

Include these foods daily:

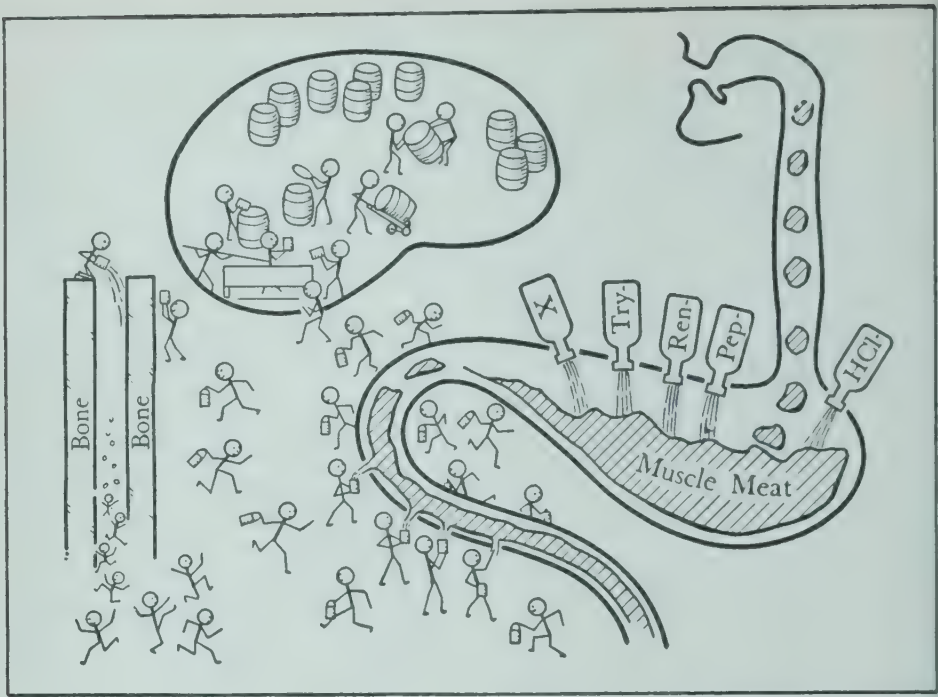
4 ounces meat, poultry, fish, or soybeans. Use liver or kidney two or more times each week. Use pork at least once a week.
1 or more eggs

1 pint milk. One ounce American cheese may be substituted for 1 glass milk
2 or more servings fruit
  1 to be citrus or tomato
  1 to be apricots, peaches, or prunes
1 potato, white or sweet
2 or more servings vegetables
  1 to be leafy, green, or yellow
Whole-grain cereals or bread
Legumes as dried peas, lentils, beans, soybeans to be used two or more times each week

TYPE DIET	SAMPLE MENU
Breakfast	
Citrus fruit or tomato	Orange juice
Egg	Poached egg
Whole-grain or enriched bread	Wholewheat toast
Butter or fortified margarine	Butter
Cereal	Oatmeal with milk
Beverage	Coffee
Luncheon or supper	
Legumes, eggs, or cheese	Baked beans with pork
Vegetable salad	Mixed green salad with French dressing
Whole-grain or enriched bread	Wholewheat bread
Butter or fortified margarine	Butter
Milk	Milk
Fruit	Stewed apricots
Dinner	
Meat	Braised liver
Potato	Baked potato
Vegetable	Stewed tomatoes
Dessert	Tapioca pudding
Whole-grain or enriched bread	Wholewheat bread
Butter or fortified margarine	Butter
Milk	Milk
Between meals	
Milk, graham crackers, or fruit	

PERNICIOUS ANEMIA

Pernicious anemia is a disturbance in which the red blood cells cannot be supplied at a rapid enough rate to replace worn out cells. The cause of the disease according to Castle is the lack of the intrinsic factor in the gastric juice. This insufficiency is almost invari-

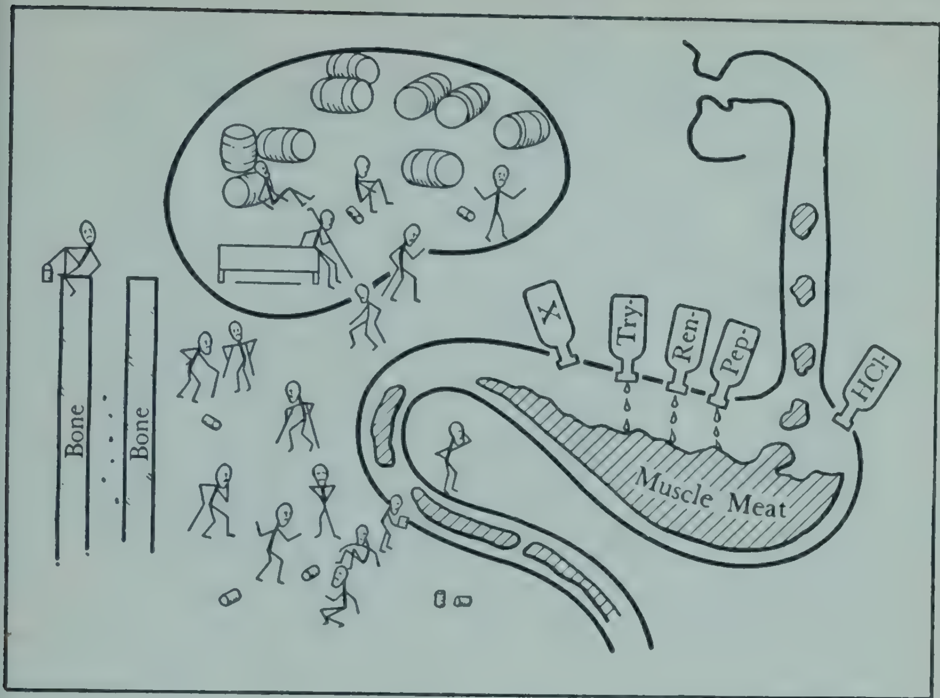


Courtesy of Dr. W. P. Murphy, "Anemia in Practice, Pernicious Anemia," W. B. Saunders Company

FIG. 32. Through the interaction of an extrinsic factor contained in muscle meat and the intrinsic factor (X) of the stomach there are produced anti-pernicious anemia substances which are stored in the liver to be utilized by the bone marrow as needed to produce erythrocytes.

ably accompanied by a deficiency of hydrochloric acid in the gastric secretion. When the intrinsic factor is lacking or is insufficient, then it is impossible to mature the blood cells normally, and the so-called pernicious anemia results. The accompanying illustrations give a very excellent idea of the blood building processes and will repay one for careful study.

Symptoms. Patients with pernicious anemia show a marked decrease in the red blood cells, a deficiency or total lack of hydrochloric acid in the gastric juice, and an absence of the antianemic factor. The digestion of the patient is more or less retarded, the appetite is poor, and a general weakness is manifested. One of the outstanding symptoms of pernicious anemia is the characteristic lemon-yellow pallor of the patient. This is rarely seen when the red-blood-cell count is above 2,500,000 per cc., and it has been seen to disappear rather quickly (7 to 10 days) after liver therapy has been introduced. A rise in temperature is likewise common, especially during the periods of relapse, when the hemoglobin and red-cell levels



Courtesy of Dr. W. P. Murphy, "Anemia in Practice, Pernicious Anemia," W. B. Saunders Company

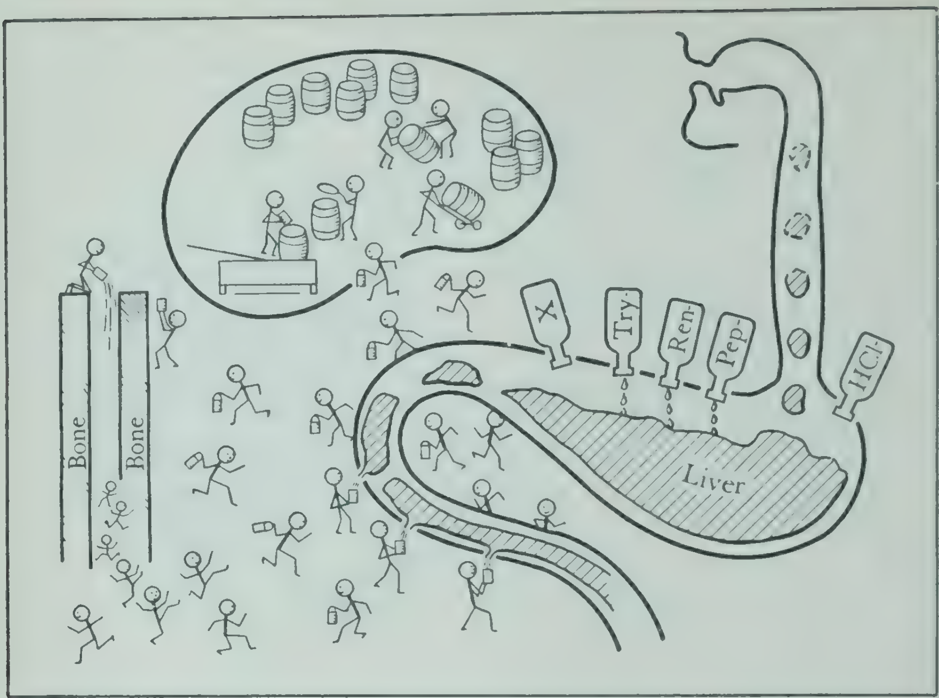
FIG. 33. Pernicious anemia results if the anti-pernicious anemia substances are not formed which may occur if either extrinsic or intrinsic factor (X) is lacking.

are both markedly lower. However, if the temperature rises to any extent (above 100° F.), some complication such as pyelitis or cystitis may be the cause. Such conditions are believed to be the cause not only of the high fever but also of a resistance to treatment.

There are evidences of change in the spinal cord manifested by a numbness in the limbs and a difficulty in walking. The mouth may become sore; the membranes of the tongue, gums, and entire gastro-intestinal tract may become dry and glazed.

Modifications of the Diet. Liver therapy was introduced in the treatment of anemia in 1926 by Drs. Minot and Murphy[5] of Boston. In the early days large amounts of raw liver were given by mouth, but at the present time liver extracts containing the anti-pernicious-anemia factor are the treatment of choice. These extracts are usually given intramuscularly, and are sufficiently concentrated that frequent injections are not necessary.

The patient who has pernicious anemia usually presents a picture of general nutritional deficiency. The dietary management is



Courtesy of Dr. W. P. Murphy, "Anemia in Practice, Pernicious Anemia," W. B. Saunders Company

FIG. 34. Return to normal erythrocyte formation will occur if the anti-pernicious anemia substances are supplied by the ingestion of whole liver or by liver extract administered by the peroral or parenteral method.

directed toward maintaining the patient in good nutrition and supplying adequate amounts of vitamins of the B complex and iron. To furnish a well balanced diet the following modifications are made:

Protein. The protein allowance should be from 100 to 150 Gm. daily. Liver, kidney, and glandular organs should be used frequently.

Fat. The fat content of the diet is preferably kept low since fats are apt to increase anorexia. Minot and Murphy suggest that it be limited to 70 Gm. daily.

Energy. Calories are usually increased though not to such an extent as to result in overweight.

Vitamins. Increased intake of all vitamins is urged since general deficiencies are apt to be present.

Minerals. The allowance of foods rich in minerals should be liberal, with special attention being given to those foods which contain readily available iron.

Consistency. If gastro-intestinal disturbances are present it may be necessary to give a soft or even fluid diet containing the essentials.

Selection of the Daily Diet. The diet outlined for nutritional anemia (page 452) is satisfactory for those patients who are receiving liver extract. The use of much liver in the diet for treatment of pernicious anemia has been largely superseded by the introduction of the factor by intramuscular injections. Whenever the injections cannot be taken because of financial or other reasons the diet of Minot and Murphy[5] is still the one of choice. (See their sample menu quoted below.)

HIGH PROTEIN DIET FOR PERNICIOUS ANEMIA

Include these foods daily:

4 to 7 ounces of liver or kidney
4 servings fruit — especially peaches, apricots, pineapple, strawberries, orange, grapefruit
4 ounces lean meat
1 to 2 eggs
3 servings vegetable — especially leafy vegetables
1 to 2 cups milk
3 teaspoons butter
Whole-grain cereal and bread
Other foods to provide sufficient calories

Avoid these foods:

All fried foods, rich gravies
All concentrated sweets
Excess salt
Fats in excess of 70 grams daily

SAMPLE MENU FOR PERNICIOUS ANEMIA

Protein, 135 Gm.; Carbohydrates, 340 Gm.; Fat, 70 Gm.

Total calories 2,500 (approximately)

Foods Allowed	Approximate Household Measures	Weight in Grams
Breakfast		
Liver or kidney, broiled		100
Oatmeal	2 heaping tbsp. cooked or dry meal	18
Sugar	2 level tsp.	10
Toast	3 slices (6 in. × 2 in. × ¼ in.)	30

SAMPLE MENU FOR PERNICIOUS ANEMIA (*Continued*)

Foods Allowed	Approximate Household Measures	Weight in Grams
Breakfast (Continued)		
Butter		5
Fruits, choice of		
Orange	1 medium	120
Strawberries	1 large serving	180
Grapefruit	1 large half	200
Peach	1 large	120
Milk	3 tbsp.	45
Dinner		
Beef, steak or roast, trimmed of fat	1 very large serving	120
Vegetables, freshly cooked:		
Spinach, string beans, cabbage; tomato, etc.	2 average portions of 5 to 8 tbsp.	250
Potato, baked	medium-size	130
Bread	2 slices (3 in. × 4 in. × ½ in.)	70
Salad: Pineapple	2½ slices of size in cans	140
Salad: Lettuce	big serving	75
Pudding made of: Gelatin	1 tsp. (dry weight)	2
Pudding made of: Rice, boiled	2 heaping tbsp.	160
Pudding made of: Raisins	20 large	50
Pudding made of: Milk	2 tbsp.	30
Supper or Luncheon		
Liver soup: Liver, minced		100
Liver soup: Milk	1 tumblerful	220
Liver soup: Flour (white)	1 tsp.	4
Liver soup: Butter	1 rounded tsp. or a piece 1 in. × 1 in. × ⅞ in.	10
Lamb roast without fatty parts	2 small pieces	60
Macaroni, boiled	3 tbsp.	150
or		
Potato or rice	1 small, 1 heaping tbsp.	80
Vegetables, fresh	2 average portions, 5 to 8 tbsp.	250
Uneeda biscuits or Triscuits	4	25
Butter	1 level tsp.	5
Fruits, choice of		
Strawberries	7 tbsp.	225
Orange	1 large	150
Apricots, stewed	2 tbsp.	100
Prunes, stewed	6 with 3 tbsp. juice	100
Sugar	2 heaping tsp.	20

SUMMARY

1. Nutritional or hypochromic anemias are usually the result of lack of sufficient iron to build hemoglobin when growth is rapid or when blood loss has occurred. They may also occur when there is interference with absorption of iron from the intestine.

2. Inadequate levels of protein, vitamin C, and minerals other than iron may also be responsible for the occurrence of nutritional anemias.

3. Deficiency anemias are characterized by skin pallor, loss of appetite, weakness, poor digestion, loss of weight, nervousness, depression, and emotional upsets. They may accompany other diseases as sprue, osteomalacia, rickets, cardiac and kidney disturbances.

4. A diet for successful treatment of secondary anemia must contain liberal quantities of foods most effective in blood regeneration; namely, liver, peaches, prunes, apricots, and organ meats. It should also allow about 100 grams of protein and high levels of vitamins. Such a diet should be supplemented with inorganic iron salts since at best the diet cannot contain more than about 20 milligrams of iron without becoming extremely bulky.

5. Pernicious anemia is due to the absence of the intrinsic factor in the gastric juice. This factor is necessary for the production of the anti-anemic principle which is used for the maturation of the red blood cell in the bone marrow.

6. Pernicious anemia is accompanied by lack of appetite, gastrointestinal disturbances, nervousness, and a marked yellowing of the skin. It differs from secondary or nutritional anemia in that the lack of the essential antianemic factor cannot be treated once and for all. The patient is obliged to continue the use of liver extract or diets rich in liver as long as he lives.

7. The diet recommended by Minot and Murphy for the treatment of pernicious anemia is high in protein and vitamins, limited in fat, and emphasizes the use of liver.

PROJECTS

1. Plan a diet for a patient with secondary anemia. Calculate the protein and iron content.

2. Plan a diet for a patient with pernicious anemia who is not receiving liver extract. Calculate the protein and vitamin C levels.

3. Suggest six ways in which liver may be served.

REVIEW QUESTIONS

1. What is meant by anemia? What are the two types?
2. What is the normal red-blood-cell count?
3. What is the purpose of the antianemic substance? How is it produced?
4. What is hemoglobin? What is its normal value?
5. What food factors are necessary for the production of hemoglobin?
6. List the causative factors in the production of secondary anemia.
7. Iron is the most important nutrient in treatment of secondary anemia. What factors may interfere with its efficient use?
8. What foods are good sources of available iron?
9. Why are high-iron diets impractical?
10. What other food factors require consideration in the diet for nutritional anemia?
11. Classify foods according to their effectiveness in blood regeneration.
12. In what respects does the diet for a patient with secondary anemia differ from a normal diet?
13. What is the cause of pernicious anemia?
14. What symptoms usually present in pernicious anemia may complicate the dietary treatment?
15. What is the most effective treatment for pernicious anemia?
16. List the dietary principles for feeding a patient with pernicious anemia.

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CHAPTER XXXIV

Diet in Gout and Arthritis

GOUT

Gout is a disease of disturbed purine metabolism characterized by a retention of uric acid in the blood and tissues, and a deposition of sodium urates in and about the joints.

The Nature and Occurrence of Uric Acid. Uric acid is the most highly oxidized of a group of nitrogenous compounds known as purine bodies. It is derived from the oxidation of certain other purine bases which in turn are the result of the breakdown of nucleoproteins. Cellular material of both plant and animal origin contains these nucleoproteins. Glandular organs such as liver, pancreas, and kidney are among the richest sources, while the embryo or germ of grains and legumes together with the growing parts of young plants also furnish appreciable amounts of uric acid and the other purines.

Metabolism and Pathological Conditions in Gout. During digestion nucleoproteins are first split into protein and nuclein, and then further cleavage takes place. The final breakdown product of nuclein is uric acid. The liver and tissues store uric acid and its precursors for variable lengths of time, and may release them later. As a normal constituent of urine, uric acid represents a part of the daily nitrogenous excretion.

There are two sources of uric acid for the body. Foods supply that of exogenous origin, and it is obvious that one can modify at will the amount of uric acid metabolized from this source by controlling the amount of purine-rich foods in the diet. There is some evidence to indicate, however, that the body can synthesize uric acid from foods which are low in purines but which are rich in protein. There is another source of uric acid, namely, that which occurs in the body even in the fasting state. This second source of uric acid, the endogenous supply, is more or less constant and the

levels in the blood and urine which are occasioned by it cannot be controlled by diet.

The deposition of sodium urate leads to swelling and pain in the joints, and the disease is frequently mistaken for rheumatism. The metatarsal joints, and the knee and toe joints are the most frequently affected. The patient with gout excretes less uric acid than normally and at the same time shows an elevated blood uric acid level.

Gout occurs in both acute and chronic forms. Acute gout is sometimes referred to as "acute arthritis" (Barborka[1]). The attacks in acute gout are usually of short duration, but recur at varying time intervals. In chronic cases of gout, deformity is often present and inflammation of the joints is more or less constant.

Predisposing Factors. Overeating and excessive drinking of stimulating beverages (alcoholic drinks especially) have long been associated with the development of gout. The overweight person of middle age is more likely to be subject to gout than the individual of normal weight. Heredity is also a factor in the development of this disturbance; it may be that an individual inherits the inability to normally metabolize uric acid and other purine bodies.

Modification of the Diet. The objectives of dietary treatment are: (1) to reduce the number and the severity of attacks of gout by limiting the exogenous sources of uric acid, and encouraging the excretion of urates; and (2) to effect a loss of weight if the individual is obese. The following modifications are necessary to accomplish these aims:

Purines. The diet for acute attacks of gout should be as nearly free of purines as it is possible to make it. This requires a most careful selection of foods (see lists on pages 463 and 733). No meats or meat extracts, fish, or poultry are allowed on such a diet. In chronic gout limited amounts of meat may be permitted.

Protein. Since the body can synthesize purines from protein foods it is considered advisable to limit proteins to the requirement for adequate nutrition — that is, to approximately 1 Gm. per kilogram of body weight.

Fat. Fats may interfere with the excretion of urates and it is preferable to limit their intake to approximately 60 Gm. daily, and sometimes less than that.

Carbohydrate. A high-carbohydrate diet is of value in effecting excretion of uric acid. If cinchophen is being used as a medication,

a liberal carbohydrate intake is of distinct worth in protecting the liver from injury.

Energy. The obese person should lose weight, and many individuals of normal weight will show improvement if a slight loss of weight — 5 to 10 per cent — is induced. Very frequently a low calorie diet (1200-1500 calories) is advisable.

Planning the Daily Diet. The diet of choice is high in carbohydrate, moderately low in fat, moderate in protein, and with the selection of foods limited to those of low purine content. Foods are here classified according to their richness in purines.

PURINE CONTENT OF CERTAIN FOODS[2]

List 1 Foods which contain very large amounts (150 to 1000 mg.) of purine bodies in 100 Gm.

sweetbreads ....825 mg.	kidneys (beef)......200 mg.
anchovies ....363 mg.	brains ....195 mg.
sardines (in oil).....295 mg.	meat extracts ...160–400 mg.
liver (calf, beef)....233 mg.	gravies ....variable

List 2 Foods which contain a large amount (75 to 150 mg.) of purine bodies in 100 Gm.

bacon	lentils	quail
beef	liver sausage	rabbit
calf tongue	meat soups	sheep
carp	partridge	shellfish
chicken soup	perch	squab
codfish	pheasant	trout
duck	pigeon	turkey
goose	pike	veal
halibut	plaice	venison
	pork	

List 3 Foods which contain a moderate amount (up to 75 mg.) of purine bodies in 100 Gm.

asparagus	herring	peas
bluefish	kidney beans	salmon
bouillon	Lima beans	shad
cauliflower	lobster	spinach
chicken	mushrooms	tripe
crab	mutton	tuna fish
eel	navy beans	white fish
finnan haddie	oatmeal	
ham	oysters	

All whole-grain bread and breadstuffs, and all whole-grain cereals including wheat germ and bran.

List 4 Foods which contain an insignificant amount of purine or no purine:

Beverages
- carbonated
- chocolate
- cocoa
- coffee
- fruit juices
- Postum
- tea

*Butter**

Breads — white bread and crackers, cornbread

Caviar

Cereals and cereal products:

corn	refined wheat
rice	macaroni
tapioca	noodles, etc.

Cheese of all kinds*

Eggs

Fats of all kinds (but eat in moderation)
Fruits of all kinds
Gelatin
Milk, buttermilk, evaporated, condensed, malted milk

Nuts of all kinds*
- peanut butter

Shad roe

Sugar, jelly, honey, sweets

Vegetables

artichokes	lettuce
beets	okra
beet greens	parsnips
broccoli	potato
Brussels sprouts	sweet
cabbage	white
carrots	pumpkin
celery	rutabagas
corn	sauerkraut
cucumber	string-beans
dandelion greens	summer squash
eggplant	Swiss chard
endive	tomato
kohlrabi	turnips

* These foods are high in fat.

Note — To calculate the purines or "purine bodies" in a given food the purine nitrogen is multiplied by 3: example, 200 mg. of purine nitrogen equals 600 mg. of purine bodies.

The low-purine diet illustrated here meets the specifications for modifications of the nutrients. If the calories are to be restricted however, the rules on page 303 should also be observed.

LOW PURINE DIET

General rules:

For acute attacks of gout foods from list 4 above are the only ones allowed. All foods on lists 1, 2, and 3 must be omitted.

For a prolonged regimen one may use all foods from list 4. In addition, one food from list 3 may be allowed four days a week, and one food from list 2 may be used on one other day of the week. The foods on list 1 must be studiously avoided.

This diet must be followed indefinitely if the attacks of gout are to be prevented or minimized. The diet is liberalized only after the blood uric acid level becomes more nearly normal.

Include these foods daily:

1 quart milk; part of this may be skim milk
2 to 3 eggs; 1 ounce cheese may be substituted for one egg
1 potato
2 servings vegetables — green or yellow; one to be raw
3 servings fruit — one to be orange, grapefruit, or tomato
2 or more servings refined cereal or enriched white bread
3 teaspoons butter
High-carbohydrate foods as white cereals, jelly, glucose, plain candy increase the carbohydrate value; if the diet must be low in calories these concentrated carbohydrates are of course contraindicated.

Foods to avoid:

All foods which are high in purines. See lists 1 and 2 on page 463.
All foods which are high in fat:
- Pastries and rich desserts
- Cream and ice cream
- Fried foods
- Eggs, whole milk, cheese, and butter in excess of the amounts stated above

Condiments and excessive seasoning
Stimulating beverages as coffee, tea, chocolate, and alcohol are often excluded

TYPE DIET	SAMPLE MENU
Breakfast	
Fruit	Half grapefruit
Cereal with milk and sugar	Rice Krispies with milk and sugar
Enriched white toast with	Buttered toast
Butter — 1 teaspoon	
Egg	Scrambled egg
Beverage	Cereal beverage with milk and sugar

TYPE DIET	SAMPLE MENU
Luncheon or supper	
Egg or cheese	Jelly omelet
Potato, macaroni, spaghetti, rice, or noodles	Boiled rice
Vegetable	Broiled tomato
Salad	Half peach with cottage cheese on lettuce; no dressing
White bread with butter	White bread with butter (1 teaspoon)
Fruit	
Milk	Milk — 1 glass
Midafternon	
Milk — 1 glass	Milk — 1 glass
Dinner	
Egg or cheese	Cheese soufflé
Potato	Baked potato
Vegetable	Beets
	Green celery strips
White bread with butter	White bread with 1 teaspoon butter
Dessert	Apple snow
Milk	Milk — 1 glass

ARTHRITIS

Arthritis is a disease of the joints, the cause of which is generally unknown. Probably few diseases have had more theories offered for the cause and treatment than has arthritis. There have been many fad diets which have been not only ineffective but also harmful. One of these diets was concerned with the theory that acid fruits caused acidosis which might lead to the development of arthritis. As a matter of fact, fruits contain certain organic acids in the form of basic salts and they function as alkalies when oxidized in the body (see Table VI on page 732). Consequently they could not cause acidosis. Another fallacy, which has been exposed, was that of giving arthritic patients a low-protein diet. This practice doubtless resulted from the idea that all types of arthritis were of gouty origin.

It has not been definitely established what the role of diet may be in the various types of arthritis. Most experimental studies on the

effect of various levels of protein, carbohydrate, and vitamin C on the occurrence or the progress of arthritis have been inconclusive.

Some dietary modification may be of value in these types of arthritis: rheumatoid arthritis, degenerative arthritis, and rheumatic fever. The last named is not true arthritis, but is an acute condition which is accompanied by arthritic symptoms.

Rheumatoid arthritis. The cause of rheumatoid arthritis is unknown. The joints become inflamed and swollen, and there is limitation of motion with deformity at times. Ankylosis may be partial or complete. The disease progresses from one joint to another. Obesity and myocardial failure may be accompanying symptoms.

There has been much discussion regarding the type of diet to be used in the treatment of this disease. Pemberton[3] in his studies of rheumatoid arthritis in the army found that the blood sugar was elevated in a majority of cases and advised a reduction of the carbohydrate content of the diet. Other clinicians question the advisability of lowering the carbohydrate intake and thus limiting the calories except in cases of obesity. The best diet is a normal diet with emphasis on these points:

1. The caloric intake is based upon the weight of the patient in relation to the desired weight; if obesity is a factor, a low-calorie diet is used.

2. A normal intake of protein — about 80 Gm. daily — is given.

3. Minerals and vitamins should be adequate in every respect. The poor nutritive state of some patients may require increased amounts of these factors until normal nutrition is assured.

4. The consistency of the diet depends upon the existing conditions. Constipation is a frequent complication and must be prevented if possible. If the type of constipation is atonic a high cellulose diet (page 349) is used; if the colon is irritable and spastic constipation occurs, the diet must be soft and low in coarse fiber (see soft moderately high cellulose diet, page 352).

Degenerative (Hypertrophic) Arthritis. This is a disorder of advancing age. The joint changes seem to be from the wear and tear of living rather than from infection or metabolic disturbances. Obesity is a very frequent accompaniment.

In this disease even a slight degree of overweight is a handicap. The pain in the joints is materially increased by pressure and the

key note to treatment lies in reducing the burden upon the sore and inflamed joints.

When there is overweight to consider, a definite reduction in calories is indicated. Excessive fats and carbohydrates in the form of sweets must be avoided. The diet on page 303 is recommended in such cases. Constipation must be prevented by the use of high cellulose diets, either of regular or of smooth consistency, depending upon the type of constipation present. The liberal inclusion of fruits and vegetables assures adequate minerals and vitamins while the daily pint of milk should not be overlooked even by those of advancing years.

Rheumatic Fever. This is a disturbance of unknown origin. It is more common in children than in adults although it may occur in either.

Rheumatic fever is always serious since it has been found that the heart is very likely to be damaged. Rest in bed is obligatory as in other acute febrile conditions. The diet is the same as that used for other fevers of short duration (see high-calorie soft and fluid diet on page 321). In acute stages a fluid diet is used with gradual progression to a soft and then a regular diet.

SUMMARY

Gout is a metabolic disturbance characterized by a retention of uric acid, and a deposition of sodium urates in and about the joints. Obesity and heredity are predisposing factors in its causation, and overeating or excessive drinking of stimulating beverages are contributory factors. The disease is less prevalent in the United States than in Europe.

Both foods and body tissues contribute to the purine metabolism, and the sources of uric acid are thus exogenous and endogenous. The intake of purine rich foods can be controlled, but the metabolism of endogenous purines is beyond dietary control and remains constant.

The diet in acute attacks of gout should be as free of purines as possible, while for long continued use in chronic gout the diet should be low in purines, although small amounts of meats, fish, and poultry may be allowed if there is a careful choice. Carbohydrates are high, fats are limited, and protein is restricted to normal require-

ments in the diet for gout. If the attacks of gout are very severe the consistency of the diet may be modified to a liquid or soft diet.

Arthritis is a disease in which the joints become swollen and painful. The disease is accompanied by limitation of motion and varying degrees of deformity and ankylosis. Whenever overweight occurs the diet must be low in calories. Constipation should be treated with the proper forms of high cellulose, either a regular high cellulose diet or a soft high cellulose diet, depending upon the type of constipation. The evidence for the use of greatly modified diets is conflicting, and the safest course is to give a diet which is normal with respect to protein, minerals, and vitamins

PROJECTS

1. Plan a diet for a patient with chronic gout. Calculate the purine content of this diet.
2. Plan a diet for a patient with chronic arthritis in whom nutritional anemia is a complication. Calculate the iron, ascorbic acid, and thiamine content of this diet.
3. Plan a diet for a ten-year-old boy who has rheumatic fever. He is 53 inches tall and weighs 55 pounds.

REVIEW QUESTIONS

1. List the chief symptoms of gout. What is the cause of gout?
2. What type of foods must be restricted in the diet used for treating gout? Why?
3. What is the difference between endogenous and exogenous uric acid? How may the amounts of uric acid metabolized in the body be controlled?
4. Why do some physicians recommend a limitation of proteins in the diet for patients with gout?
5. What is the basis for a limited fat intake?
6. How is carbohydrate modified in the diet for gout? Why?
7. What types of arthritis are most apt to require dietary modifications?
8. What are the most frequent modifications of the diet which may be necessary for the patient with arthritis?
9. What type of diet is especially recommended for the patient with acute rheumatic fever?

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CHAPTER XXXV

Diet in Allergic and Skin Conditions

ALLERGY

Allergies represent the abnormal reaction of an individual to the food he eats, the air he breathes, or the substances he touches.[1] Rowe[2] defines food allergy as a "hypersensitiveness established in the body cells to specific foods."

The recognition of idiosyncrasy to various foods is not a new discovery. Hippocrates recognized this fact 2300 years ago, and the old adage "What is one man's meat is another man's poison" was derived from a saying of Lucretius in the year 100 B.C. However, allergy as a medical specialty has been recognized only within the last two decades. At present both medical men and the lay public have become allergy conscious, sometimes too much so.

Causes. It was believed for many years that a substance must contain protein in order to bring about an allergic reaction. However, this has been questioned since many substances, as aspirin for example, which are entirely free from protein can do so.

There are many "allergens", an allergen being "anything that generates or produces allergy" (Henry[1]). It is not the substance itself which is at fault but the individual who has become sensitive to the substance. Food is just one of the allergen groups. Others are various drugs, house dust, pollens, the sap of certain plants as poison ivy, hair or fur of animals, horse dander, orris root, odors (food, perfume, etc.), changes in temperature, climate, vaccines, and extracts to mention but a few.

Only food allergies will be discussed here. Certain foods have been shown to be more frequent allergens than others. In the order of their frequency, these foods are common offenders: eggs, milk, grapefruit, wheat, orange, tomato, chocolate, and potatoes.

Heredity is an important factor in the causation of allergy since the tendency to allergy is transmitted from generation to genera-

tion. A child born of a parent who suffers from asthma need not develop asthma; as a rule, if the child becomes allergic, the symptoms will be in some other form such as gastro-intestinal disturbances, eczema, etc. Frequently a whole generation may escape, but sooner or later some member of the family will become sensitive. It is possible for a child to become sensitive before birth because of contact with something in the mother's blood; for example, infants have become sensitized to eggs in this manner. In such instances, if the child is breast fed he will probably develop allergic symptoms when the mother eats eggs; if fed upon a formula the symptoms will not occur until eggs are added to his diet. Children seem to develop allergies more readily than adults, and, unlike adults, the condition is likely to grow worse as the child grows older if the condition is not controlled.

Manner of Induction. Allergies may be brought about by various means, as:

1. By ingestion. Many skin diseases are of allergic foundation. Lesions are caused by food, drugs, or other products taken into the mouth. These products are absorbed from the gastro-intestinal tract into the blood stream and are thus carried to the sensitive part of the skin.

2. By contact, that is touching the substance to which the individual has become sensitized. Certain individuals develop such a severe degree of sensitivity to foods such as celery, tomatoes, peaches, figs, and shell beans that the mere handling of them will bring on an acute attack of dermatitis.

3. By inhalation of odors, dust, etc.

Some Characteristics of Allergies. All allergic individuals do not react alike. Some are only mildly sensitive and can eat a particular food for several days before characteristic symptoms develop, while others have violent reactions within an hour or two. No part of the body is immune. If a part has become sensitive, symptoms will develop whenever contact is made with the offending allergen. They may occur in:

1. The skin. Skin lesions are among the most frequent symptoms of allergy. Dermatitis of various types as urticaria, nettle rash, etc. are common.

2. The gastro-intestinal tract. Nausea, vomiting, and diarrhea

are common manifestations. Allergic colitis may be of three types: (a) acute in which diarrhea with watery stools develops; (b) chronic in which the stools contain large amounts of mucus; and (c) spastic characterized by the development of spastic constipation. Symptoms of appendicitis are sometimes of allergic origin. A condition which simulates gastric ulcers may be produced by allergy. Sometimes an actual ulcer will not respond to treatment because the individual is allergic to some of the foods used in the dietary treatment.

3. The nasal passages. Head colds and sinus headaches may be caused by allergens.

4. The mouth. Canker sores or ulcers, and fever blisters occur when the individual eats certain foods to which he is sensitive.

5. The liver and gallbladder. Conditions which are similar to cholecystitis have caused much confusion in diagnosis.

6. Loss of weight or failure to gain in children. This is probably one of the most recent discoveries in the field of allergy.

It has been observed that certain characteristics develop in allergic individuals: (1) The blood pressure is lower in allergic persons than in normal individuals; this is not harmful to the individual with allergies. (2) The majority of allergic people are alert and energetic. (3) The consensus of opinion is that such sensitive individuals show a mentality above the average. (4) Allergic individuals seem to be relatively free from such chronic diseases as diabetes, nephritis, hyperthyroidism, and are often able to withstand infections better than normal individuals.

Diagnosis of Allergies. The need for a complete history of the patient is clearly indicated. Individual likes and dislikes must be taken into consideration. One patient may dislike an important food and claim to be allergic to that food in order not to be called upon to eat it. Another may like a food sufficiently to be willing to risk an attack in order to eat it. A carefully kept record of food eaten and of the occurrence of symptoms is in many instances sufficient to establish what the offending factor may be.

The Scratch Test. The scratch test consists in dropping a bit of solution suspected of causing allergy on to a scratch made on the back or arm of the patient. If a red inflammation or hivelike wheal appears at the site of the scratch the injected material is suspected

as an allergen. The scratch test is suggestive but not conclusive. A positive test does not necessarily mean that the patient is sensitive at the time to the material; it may represent a past sensitivity. Research has indicated, however, that this patient has the tendency to become sensitive at some future date.

After the skin tests have revealed the foods which are, or may be, at fault, a trial diet is arranged excluding all these foods. Even the foods which give a very mild reaction are omitted. The diet is used for three weeks, and then each of the suspected foods is returned to the diet, one at a time. If the food added causes the symptoms to reappear, it is eliminated temporarily or permanently from the diet. When such important foods as milk, eggs, or wheat give a positive reaction, each is tried separately for four or five consecutive days before adding the next.

The Elimination Diet. There are a number of elimination diets which have been valuable as diagnostic aids. Each group of diets is so planned that common allergens are eliminated from one or more of the diets. The history of the patient and the results of scratch tests will determine which diet is to be used first. If an individual shows marked symptoms when eating one diet for a few days up to three weeks, he is placed on another diet. Each of the several diets in a group may be tried. If the patient is symptom free on one of the diets, foods are added one at the time at intervals of three or four days. Any food which causes symptoms to reappear is immediately excluded from the patient's dietary. If the patient shows no improvement on any of the diets of a given regimen, the allergy is probably not of food origin and another cause must be sought.

The Synthetic Diet. A synthetic diet consisting of amino acids, glucose, emulsified fats, mineral salts, and vitamin concentrates has been devised by Olmsted and his associates.[8] Such a diet has been of value in determining whether an individual is allergic to food, since none of the constituents of the feeding itself will produce allergy. The feeding is given through a tube inserted into the stomach. Patients who are allergic to food show marked improvement in a few days, while those who are sensitive to other materials than food will not improve. Consequently, the feeding is a quick means of determining the approximate cause of the allergy. If it has been

ascertained that food is responsible for the allergy the feeding can be continued over a longer period of time, adding first one and then another of the important foods to determine which ones may be safely included and which ones should be omitted. The reader should refer to the original article for exact directions in the preparation of the feedings.

Planning the Elimination Diet. Many foods unlike in flavor and structure belong to the same botanical group. It is possible for an individual to eat a food which appears to be wholly unlike the one to which he is allergic only to have the characteristic symptoms appear. For example, a man who is sensitive to cottonseed products may eat okra and develop the same symptoms; on investigation, it is found that these dissimilar substances belong to the same botanical family, that is the Mallow family. The following botanical classification of some common foods illustrates the relation of foods which may at first thought appear to be dissimilar:

Cereal	*Lily*	*Gourd*	*Cabbage and Mustard*
Wheat	Onions	Squash	Turnips
Rye	Garlic	Pumpkin	Cabbage
Barley	Asparagus	Cucumber	Collards
Rice	Chives	Cantaloupe	Cauliflower
Oats	Leeks	Watermelon	Broccoli
Malt	Shallots	Muskmelon	Kale
Corn			Radish
Sorghum			Horseradish
Cane sugar			Watercress
			Brussels sprouts
			Kohlrabi

Buckwheat is not of the cereal family but in a group which includes rhubarb. The sweet potato is not related to the Irish potato but is a member of the morning glory family. Spinach, a frequent reactor, is in the same family with beets.

Just as some foods are very common allergens, so others are infrequently responsible for sensitiveness. Some of the latter are:[4]

Mulberries	Salsify (oyster plant)	Sugar
Blackberries	Chicory	Salt
Currants	Endive	Maple syrup

Gooseberries	Okra	Pistachio nuts
Rhubarb	Chestnuts	Gelatin
Cranberries	Olives	Figs
	Buckwheat	Sweet potato

One of the stumbling blocks in the use of elimination diets is the impatience or unwillingness on the part of the patient to give the diet a fair trial. When a new food is added to the diet an opportunity must be given for it to react before another is added; otherwise the causative factors cannot be determined. Exact attention must be paid to the foods allowed, since not a single food should be eaten which does not appear upon the allowed list. This entails a knowledge of the composition of foods. A list of foods to avoid for wheat, eggs, or milk is given below (pages 480 to 482).

The majority of elimination diets are low in minerals and vitamins, and at times in protein. If a diet without milk is used, meat should be provided at least twice a day and calcium should be prescribed as a medication. Vitamin concentrates may be used. A single elimination diet should not be used for more than three weeks. If improvement has occurred on a diet, foods are added one by one, with this diet as the basis, until the nutritional requirements can be met. Two popular elimination regimens will be listed here:

ELIMINATION DIETS

(From Presbyterian Hospital in New York City[5])

General rules:

Diet I is free from all of the allergens to which more than 10 per cent of the patients have reacted. Since many patients are not allergic to wheat and milk, diet II has been arranged to contain milk but no eggs or wheat, while diet III contains wheat but no eggs or milk. The choice of the diet will depend upon the history of the patient and on the skin tests.

Sugar, salt, and gelatin which are considered to be non-allergic are the only foods common to the three diets.

No diet should be continued for longer than three weeks. If there is no improvement at the end of that time, another diet should be tried. If there is improvement, one new food may be added every third or fourth day in sufficient quantity to determine the effect. The common sensitizing foods should be added last.

DIET I. NO MILK, WHEAT, OR EGGS

Foods allowed:

- Beverage
  - Coffee
  - Grape juice
  - Lime juice
- Cereal
  - Cornmeal
  - Hominy grits
  - Post Toasties
- Bread — Corn pone
- Meat
  - Lamb
  - Salmon
  - Lamb liver
- Fruits — raw, canned or dried
  - Apricots
  - Dates
  - Grapes
  - Lime
  - Pears
  - Raisins
  - Raspberries
- Vegetables — cooked, canned or raw
  - Beans
    - navy
    - string
    - Lima
    - wax
    - kidney
    - soy
  - Carrots
  - Corn
  - Escarole
  - Kale
  - Lettuce
  - Parsnips
- Fat — Mazola oil
- Nuts — Walnuts
- Miscellaneous
  - Karo
  - Gelatin
  - Molasses
  - Sugar

Suggested Menu

Breakfast

Grape juice or fruit from list
Post Toasties, cornmeal or hominy grits — no milk
Corn pone — no butter
Coffee — no milk

Luncheon

Lamb or salmon
Vegetable from list — no butter
Lettuce or raw carrot salad — no mayonnaise
Fruit from list
Corn pone

Dinner

Lamb or salmon
Vegetable from list — no butter
Fruit from list
Corn pone
Coffee — no milk

DIET II. ALLOW MILK—NO WHEAT OR EGGS

Foods allowed:

- Beverage
  - Milk
  - Pineapple juice
  - Prune juice
- Cereal
  - Rice
  - Puffed rice
  - Rice Krispies
- Bread — Ry-Krisps
- Meat
  - Chicken
  - Pork
  - Halibut
  - Chicken or pork liver
- Fruit — raw, canned or dried
  - Peaches
  - Pineapple
  - Plums
  - Prunes
  - Loganberries
- Vegetables — cooked, canned or raw
  - Asparagus
  - Artichoke
  - Celery
  - Collards
  - Eggplant
  - Endive
  - Radishes
  - Sweet potato
  - Swiss chard
  - Turnips
- Fats
  - Butter
  - Cream
- Nuts — Pecan
- Miscellaneous
  - Cheese
  - Salt
  - Sugar
  - Gelatin

Suggested Menu

Breakfast

Pineapple or prune juice
Puffed rice, Rice Krispies or boiled rice with milk
Ry-Krisps with butter
Bacon or ham if desired
Milk

Luncheon

Meat from list or cheese
Rice or sweet potato
Vegetable from list
Ry-Krisps
Fruit from list
Milk

Dinner

Meat from list
Sweet potato
Vegetable from list
Rice pudding made without egg or fruit from list
Milk

DIET III. ALLOW WHEAT—NO MILK OR EGGS

Foods allowed:

Beverage
- Tea
- Lemonade

Cereal — Any pure wheat cereal as Cream of Wheat
- Farina
- Ralstons
- Shredded Wheat
- Wheatena
- Macaroni
- Spaghetti

Bread
- French bread
- Hard or water rolls
- Bread sticks
- Home made biscuits
- Matzoth
- Soda crackers

Meat
- Beef
- Veal
- Beef or calves' liver
- Mackerel

Fruits — raw, canned or dried
- Apple
- Banana
- Figs
- Lemon
- Rhubarb
- Strawberries

Vegetables — cooked, raw or canned
- Potato
- Beets
- Beet greens
- Brussels sprouts
- Cabbage
- Cauliflower
- Cucumbers
- Green peppers
- Lettuce

Suggested Menu

Breakfast

Fruit from list
Cereal from list — no milk
Bread from list with apple jelly, strawberry jam, or peanut butter
Tea with lemon

Luncheon

Meat from list
Macaroni, or spaghetti, or potato — plain — no milk or butter — or meat sandwich on French bread
Raw cabbage, cucumbers or watercress — no mayonnaise
Fruit from list
Tea or lemonade

Dinner

Meat from list
Potato — no butter
Vegetable from list — no butter
Fruit from list
Bread from list — no butter
Tea

DIET III. ALLOW WHEAT—NO MILK OR EGGS *(Continued)*

Foods allowed (*Continued*):

Vegetables—cooked, raw or canned (*Continued*)
- Mushrooms
- Squash
- Watercress

Fats
- Crisco
- Wesson oil
- Peanut oil

Nuts — Peanuts

Miscellaneous
- Apple Jelly
- Apple or rhubarb pie made with Crisco
- Gelatin
- Maple syrup
- Peanut butter
- Salt
- Sugar
- Strawberry jam

The following lists of foods are helpful to individuals who must plan diets where wheat, eggs, or milk cannot be used in any form.

DIET WITHOUT WHEAT

Foods to avoid:

Beverages — malted milk, Postum, Mellin's food, Nestle's food.

Bread — all breads including rye and oatmeal, hot breads and muffins, corn bread, baking powder biscuits, etc.; zwieback, pretzels, and gluten bread.

Cereals

Farina	New oats	Shredded Ralstons	Kix
Cream of wheat	Bran flakes	Wheat flakes	Meads
Ralstons	All-bran	Muffets	Ralstons Super-farina
Pettijohns	Whole bran	Wheaties	
Wheatena	Shredded wheat	Mellowheat	
Grapenuts	Grapenut flakes	Krumbles	Crackels
Puffed wheat	Pablum	Wheatsworth	Pep

Crackers — all crackers and cookies

Desserts — pies, cookies, cakes, doughnuts, ice cream cones

Griddle cakes, waffles, pancakes, either home-made or commercially prepared as: Aunt Jemima, etc.

Gravies or sauces thickened with flour
Macaroni, spaghetti, noodles, or vermicelli
Meat prepared with flour, bread or cracker crumbs as croquettes and meat loaf or stews thickened with flour or made with dumplings.
All commercially prepared meats as frankfurters, sausages, or meat loaf where wheat may be used as a filler.
Canned broth or consomme
Salad dressings — all cooked or boiled salad dressings where flour is used for thickening.
Flour in any form including graham, white, or wholewheat.

DIET WITHOUT EGGS

Foods to avoid:

Eggs in any form
Ice cream
Noodles
Mayonnaise or hollandaise sauce
Custard
Milk puddings containing eggs
Cakes
Cookies
Ovaltine
Cocomalt
Marshmallows
Meringue
Soft pies as lemon, custard, pumpkin, cocoanut, etc.
Soft candy as chocolate cream, nougat, or fondant
Eggnogs or other egg drinks
Meat prepared with egg as meat loaf, breaded meat

DIET WITHOUT MILK

Foods to avoid:

Butter
Cream
Milk
Buttermilk
Evaporated milk
Cheese
Ice cream
Malted milk
Cocomalt
Ovaltine
Milk puddings
Custards
Bread except rye
Cream soups
Cream sauces
Mashed potatoes

DIET WITHOUT MILK *(Continued)*

Foods to avoid (*Continued*):

Vegetables seasoned with butter or creamed
Gravy made with milk, cream, or butter
Cake or cookies made with milk
Chocolate candy
Caramels
Pie crust made with butter
Cream or soft pies
Zwieback
Cream of rice

ROWE'S REVISED ELIMINATION DIETS[2]

DIET I	DIET II	DIET III	DIET IV
Cereal**: rice, tapioca	Cereal**: corn, rye, cornstarch, Ry-Krisps	Cereal: tapioca	Milk: 2–3 quarts
Meat: lamb	Meat: chicken, bacon	Meat: beef, bacon	Tapioca cooked with milk
Fats: olive or cottonseed oil	Fats: corn oil, cottonseed oil, bacon fat	Fats: bacon fat, olive oil, Wesson oil (cottonseed oil)	
Vegetables: lettuce, spinach, carrots, beets, artichokes (exclude legumes)	Vegetables: tomato, squash, asparagus, peas, string beans	Vegetables: Lima beans, soy beans, string beans, beets, carrots, tomatoes, white and sweet potatoes	
Fruits: lemon, pear, grapefruit	Fruits: pineapple, peaches, prunes, apricots	Fruits: lemon, grapefruit, apricots, peaches	
Miscellaneous: maple sugar, gelatin, cane sugar, olives, preserves, jams, or marmalade from allowed fruits	Miscellaneous: salt, cane sugar, corn syrup, gelatin	Miscellaneous: cane sugar, syrup flavored with maple, maple syrup, salt	

**Breads and muffins may be made from allowed foods, provided no food material other than those on the lists is included in the preparation.

Diet I	Diet II	Diet III (Cereal Free)
Breakfast	*Breakfast*	*Breakfast*
Grapefruit or pear Boiled rice, Rice Krispies, Puffed Rice or rice cakes Maple syrup or juice from canned pears to replace usual cream or milk Coffee with sugar	Stewed prunes Cornflakes (use corn syrup or juice from an allowed fruit to replace the usual milk or cream) Broiled bacon Rye or corn muffins Coffee with sugar	Lima-bean flakes or tapioca cooked in water and flavored with maple syrup Soybean and potato muffins Broiled bacon Coffee with sugar
Dinner	*Dinner*	*Dinner*
Roast lamb Spinach, carrots Lettuce with lemon juice and olive-oil dressing Rice or tapioca with stewed pears Olives Rice bread (if desired)	Chicken soup (may be thickened with cornstarch) Baked hominy Broiled or baked chicken Asparagus, sliced tomatoes with lemon juice, salt, and Wesson oil or Mazola Ry-Krisps Pineapple ice or sliced pineapple	Beefsteak or roast beef Candied sweet potato String beans Sliced beets with lemon juice Soybean muffin Apricot ice
Supper or Luncheon	*Supper or Luncheon*	*Supper or Luncheon*
Lamb stew with carrots and rice Sliced beet salad with lemon juice Apple tapioca, no milk Coffee with sugar	Baked corn-meal mush with bacon on top Green peas Asparagus salad with lemon juice, salt, and Wesson oil or Mazola Ry-Krisps Apricot gelatin Coffee or tea	Beef broth with tapioca Baked potato (Irish) Beef and potato hash Grilled tomato Soybean muffin or Lima-bean muffin Canned peaches, apricots, or grapefruit Coffee or tea

DISEASES OF THE SKIN

There are a number of skin diseases, some of which may be of allergic origin while others may be the result of other causes. Most skin disturbances occur in both acute and chronic forms. The acute

stages usually yield to treatment without undue delay while the chronic condition may take weeks or months to eradicate.

The physician must first determine the cause of the disturbance. Treatment is then instituted according to the needs of the individual case. It may take the form of some medication or it may require a special diet which eliminates allergens. Urticaria and eczema frequently result from some sensitivity to foods, but eczema has been known to occur after shock, hearty laughter, fear, or anger.

Urticaria (Hives). Urticaria is one of the most common manifestations of food allergy. One may be perfectly well one hour and suffering the extreme discomfort of itching, swelling of the eyes, lips, etc. the next. Certain individuals develop urticaria after eating strawberries, while others find that a dose of aspirin or certain vitamin concentrates or some drug may cause the wheals to develop. The treatment is directed first at finding the cause; if food is suspected, an elimination diet may be needed to establish the cause (see page 476).

Acne Vulgaris. Acne vulgaris is the most common type of skin disease. There is a preponderance of oily secretions from the sebaceous glands which favors the location and multiplication of certain types of bacteria which cause infection in the entire region. Gastrointestinal disturbances and sensitivity to certain foods are causative factors. The skin lesions are located on the face, the neck, and the shoulders. At times they are so deep as to produce scarring of the skin.

The treatment for this type of acne is directed toward removing the cause or causes, proper medication, a corrective diet, and improvement of the personal hygiene. A diet which is somewhat lower than normal in carbohydrate has been used with success, most of the carbohydrate coming from fruits and vegetables. Easily digested fats may be used in somewhat increased amounts, but greasy and fried foods must be avoided.

Foods allowed:

Milk and milk products
Eggs, except fried
Cottage and cream cheese
Meat, fish, and fowl
Bread in moderate amounts, if at all
Butter and other digestible fats
Fruits and vegetables of all kinds

Foods to avoid:

Any food to which the individual may be sensitive
Fried and greasy foods including fat meats
Cereals and possibly bread
Starchy foods as macaroni, spaghetti, noodles, rice, tapioca
Starchy puddings
Excessive seasonings
Stimulating beverages as coffee, tea, chocolate, alcohol

Acne Rosacea. This is a less common type of disturbance which is characterized by an impairment of the sebaceous glands. There are local vascular disturbances causing a dilatation of the blood vessels. The angry red and blotchy appearance of the skin is aggravated by the taking of strong coffee, tea, or alcohol. Constipation is a common finding.

A diet which is light but adequate is indicated. Vitamins, especially of the B complex, should be used in increased amounts. Fried foods and those rich in fats as gravies, fatty meats, and pastries should be avoided. Stimulating beverages and condiments must be eliminated. Sour milk sometimes gives better results than fresh whole milk.

SUMMARY

Allergy represents the abnormal reaction of an individual to the food he eats, the air he breathes, or the substances he touches. It is the individual that is at fault and not the substance itself.

Materials which cause allergic symptoms are called allergens. Certain foods as milk, eggs, wheat, potatoes, grapefruit, oranges, and tomatoes are more common offenders than others. Very few individuals react to gelatin, salt, and sugar.

Foods are not the only allergens, since sensitivity may develop by the inhalation of dust, horse dander, pollens, etc., or by contact with materials such as poison ivy.

Diagnosis of allergies is based on the patient's history, the results of scratch tests, and on the reaction to various trial or elimination diets.

A trial diet consists of foods to which the individual has no sensitivity. After three or more days foods are added to this diet one by one, allowing a few days between each addition to determine

the full effect of the new food. If symptoms do not develop following the addition of a new food, such food can be retained in the dietary. The permanent diet of the patient is thus eventually established.

Careful instruction of the patient is essential if the trial diet is to be used with success. No food which appears on the list of foods to be avoided should be included until directed by the physician.

No elimination diet should be used without change for more than three weeks. Most of the elimination diets are deficient in minerals, vitamins, and sometimes protein, and supplementation is usually necessary.

Foods are frequently rendered more usable if they are prepared in a different manner. For example, toast or zwieback are sometimes tolerated when fresh bread or biscuits are not. Evaporated milk may sometimes be used when fresh milk causes violent reactions. These points should be considered, especially if the food is an important one which it is difficult to rule out of the dietary.

A number of skin conditions may or may not be of allergic origin. Acne, for example, at times clears up entirely when the patient is placed on a light adequate diet with some restriction of concentrated carbohydrates. In other cases, however, the condition is most refractory to treatment. In the treatment of skin conditions it is important to determine the cause, to emphasize a simple adequate diet, and to stress good skin care and personal hygiene. Constipation should be avoided by including adequate bulk in the diet.

PROJECTS

1. Plan a day's menu for a patient who is sensitive to milk and eggs.

2. Plan a day's menu for a patient sensitive to wheat, potatoes, and grapefruit.

3. Calculate a diet for a six-year-old child who is sensitive to milk, eggs, and wheat. Include all of the nutritional essentials.

REVIEW QUESTIONS

1. Define: allergy; allergen; food allergy; scratch test; elimination diet.

2. Name five foods to which the greatest number of food allergies are due.

3. Name some foods which rarely cause sensitivity.

4. On what basis would you expect an individual to show symptoms after eating watermelon if you knew he was sensitive to squash?

5. List some of the botanical classifications of foods and list three foods in each class.

6. What are the principles for the construction of elimination diets?

7. What are some of the shortcomings of the elimination diet?

8. Name some of the characteristic symptoms of allergies.

9. What is the customary treatment for a patient who exhibits various allergic symptoms?

10. What are the chief symptoms in: urticaria; acne vulgaris; acne rosacea; allergic colitis; simulated gastric ulcer.

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CHAPTER XXXVI

Diets and Tests for Diagnostic Purposes

There are many conditions in which certain dietary procedures must be used in order to make a diagnosis. In some cases it is necessary to omit or greatly reduce certain nutrients in the diet before starting the test. It may be necessary to use one food substance only, as in testing the patient for glucose tolerance. To illustrate such conditions, a few test diets and procedures have been included here, though the list is by no means complete.

URINE TEST FOR SUGAR

(Benedict Qualitative Test)

Procedure. Place exactly 4 drops of the urine in a test tube and add exactly 2.5 cc. of Benedict's qualitative solution. Place the tube in a vessel of bubbling boiling water, and allow it to remain there exactly five minutes. If an abnormal or pathologic amount of sugar is present, a greenish-yellow, reddish-brown, or red turbidity or precipitate results, which renders the solution opaque. (If a broken pipette is used to measure the amount of urine and reagent or if the test tube is held over an open flame, the accuracy of the test may be impaired.) Do not use Benedict's quantitative solution for this test.

Significance. The changes in color due to the presence of sugar in urine, as in diabetes mellitus, may be interpreted as follows:

1. The turbid green represents a trace of sugar; if the specimen is clear green, sufficiently so to allow print to be read through it, this specimen is considered negative.

2. A change to yellow indicates the presence of about 1 to 1.5 per cent.

3. A change to red indicates the presence of about 4 per cent.

Urine without sugar | Urines with trace of sugar | Urine with much sugar

Plate from Wilder, Russell M., "Diabetic Primer," 3rd ed.
Courtesy of Dr. Wilder and W. B. Saunders Co.

FIG. 35. THE BENEDICT TEST FOR SUGAR IN THE URINE

URINE TEST FOR DIACETIC ACID

(Gerhardt's Ferric Chloride Test)

Procedure. Pour 1 teaspoon (5 cc.) of freshly voided urine into a clean test tube and add, drop by drop, a 10 per cent solution of ferric chloride, noting the change of color during the process. In the presence of diacetic acid the color of the specimen changes to a wine red. Ferric chloride solution is added until there is no further deepening of the color. One half of the specimen just tested is then poured into a second tube which is heated over the flame three minutes or in boiling water five minutes. If diacetic acid is present, the color will fade to a lighter color. If the patient has been taking aspirin or antipyrine, the color will be a bluish red and remain so when the specimen is heated.

Significance. If diacetic acid is present, the patient should take a specimen to his physician. It is a serious symptom and may indicate approaching diabetic coma.

GLUCOSE TOLERANCE TEST

Test Diet. Give 1.75 Gm. glucose per kilogram of body weight. Use about 10 cc. of water for each 4 Gm. of glucose. Lemon juice may be used for flavoring, if desired. Some physicians give 100 Gm. of glucose irrespective of the patient's weight.

Procedure. Give prescribed amount of glucose in the morning after a fast of 12 hours or more. Obtain blood samples for sugar determinations at the end of the first half hour after giving the glucose, and also at the end of the first, second, and third hours. Collect urine samples and test them for sugar.

Significance. The blood sugar rises sharply at one half to one hour after giving glucose to normal individuals. It falls to the original level by the end of the second hour, if the individual has a normal sugar tolerance (see Fig. 36).

In diabetes mellitus the maximum sugar concentration is reached at about the end of the second hour, and is slow in returning to the normal value.

The glucose tolerance curve is very flat in Addison's disease, in hypothyroidism, and in hyperinsulinism.

Elevation of the glucose tolerance curve is characteristic of hyperthyroidism.

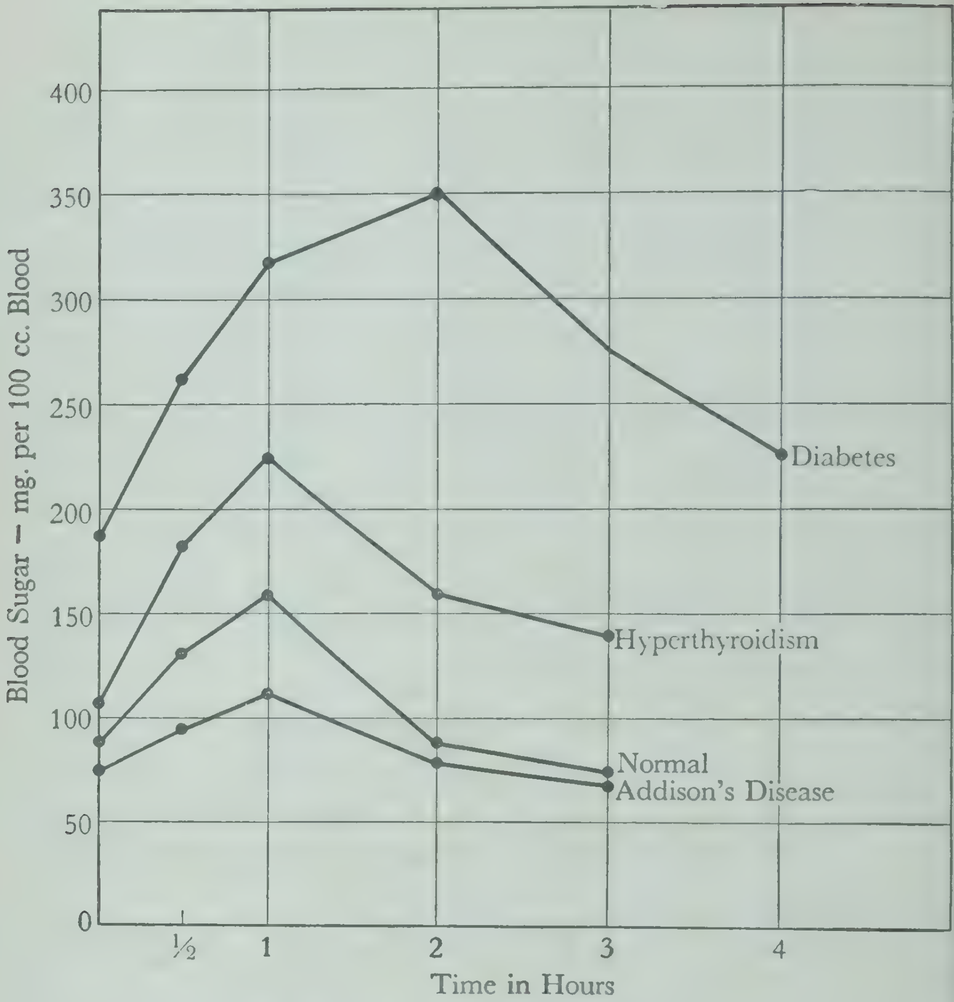

Fig. 36. Glucose Tolerance Curves

GASTRIC ANALYSIS

Purpose. To examine the contents of the stomach in order to determine gastric acidity, and emptying time of the stomach.

Test Meals. Test meals of various sorts are usually given to stimulate secretion of gastric juices.

Ewald Test Diet. The following meal is given on an empty stomach, usually in the morning:

4 large soda crackers or 2 slices bread without butter or 1 shredded wheat biscuit

1½ glasses (300 to 400 cc.) water or weak tea; no cream or sugar

Alcohol Test Meal. Fifty cc. of 7 per cent grain alcohol is injected into the fasting stomach through a small tube. Stomach contents

are aspirated before giving the alcohol, and at 10 minute intervals following its introduction.

Histamine. After the patient has fasted for 12 hours or more a calculated dose of histamine is injected hypodermically. Histamine is a very powerful stimulant, and is not wisely used for some patients.

Motor Meal. A full meal is given to determine the rate at which food leaves the stomach. It includes such substances as tea leaves, berries with seeds, or raspberry or blackberry jam. The contents are allowed to remain in the stomach for a longer period before withdrawal is begun. The rate of passage shows whether the motor processes are impaired.

Barium or Bismuth Meal. It is customary to give the patient a bismuth or barium meal in order that an x-ray and fluoroscopic examination may be made to determine the character and extent of the disturbance. This meal consists of a pint of fluid, either buttermilk or malted milk, into which a certain amount of bismuth or barium chloride is mixed. The progress of this meal can be studied throughout the entire intestinal tract. It is possible to determine emptying time, motility, and defects suggestive of disease.

Procedure. The stomach is emptied and the contents are examined. The test meal is then given, and a stomach tube is reinserted. The tube is left in place and specimens of the stomach contents are obtained at stated intervals, usually at 15 minute intervals for about 2 hours.

Significance. Amounts of fluid in excess of 50 to 100 cc. for the first hour after an Ewald meal indicate hypersecretion or stasis, while volumes less than 20 cc. are likely when emptying of the stomach is too rapid.

An increase of hydrochloric acid (hyperchlorhydria) may occur in peptic ulcers and in gastritis. A decrease of hydrochloric acid (hypochlorhydria) is significant in carcinoma in the early stages, chronic gastritis, and pellagra. Absence of hydrochloric acid (achlorhydria) is indicative of advanced carcinoma, pernicious anemia, some cases of pellagra, and occasionally of tuberculosis.

The diminution or absence of pepsin or rennin occurs in various organic stomach disorders. The presence of blood in the stomach contents usually indicates ulcers or carcinoma.

DUODENAL DRAINAGE

Purpose. To obtain duodenal contents for chemical, microscopic, or bacteriological examination.

Procedure. Allow no food for 12 hours before the test until after completion of the test. A flexible rubber tube is swallowed by the patient. It is carried into the duodenum after a time and the fluid begins to siphon out. Tests may then be made on the collected contents.

Significance. Diminution or absence of amylopsin, steapsin, or trypsin indicates subnormal secretion of the pancreas or obstruction of the pancreatic duct. An excess of pus cells gives information on the possibility of inflammation of the duodenum. The presence of bile in the duodenal fluid rules out obstruction of the hepatic or bile ducts. An increase of urobilin is of significance in the diagnosis of hemolytic anemias.

INTESTINAL TEST DIET

Purpose. Test diets are used to determine the specific character of the diarrhea, whether it be acute or chronic.

Schmidt Intestinal Test Diet.[1] The following test diet is used for three days:

Breakfast

Milk, 1 pint (450 cc.)
Vienna roll (45 Gm.) or 1½ slices toast
Butter, ½ tablespoon (8 Gm.)
Eggs, 2 soft boiled

Midmorning

Thick oatmeal gruel made with milk (150 cc.)
Sugar, 1½ teaspoons (7 Gm.)

Luncheon

Cream of potato soup, ½ cup (125 cc.)
Scraped beef, 4 ounces (115 Gm.)

Midafternoon

Milk, 1 pint (450 cc.)
Vienna roll, one (45 Gm.) or 1½ slices toast
Butter, ½ tablespoon (8 Gm.)

Dinner

Thick oatmeal gruel made with milk, ⅔ cup (150 cc.)
Sugar, 1½ teaspoons (7 Gm.)
Eggs, 2 soft boiled
Vienna roll, one, or 1½ slices toast
Butter, ½ tablespoon (8 Gm.)

Significance. The feces are examined for the presence of starch granules, presence of muscle fibers, and fat material. If starch granules are present a deficiency in starch digestion is indicated. Likewise, the presence of muscle fibers suggests inadequate pancre-

atic function. The length of time for the passage of the diet through the gastro-intestinal tract is about 20 to 36 hours in normal individuals, but the time is much shorter in diarrhea and greatly prolonged in intestinal stasis. It is possible to determine the nature of a diarrhea by comparing the feces from a patient on this diet with those obtained from a normal individual on the same regimen.

GALACTOSE TOLERANCE

Purpose. To determine the ability of the liver to convert galactose to glycogen.

Procedure. Omit breakfast and lunch. Give 40 Gm. of pure galactose in 500 cc. of water flavored with lemon juice. Allow water as desired. Collect urine hourly for five hours and test quantitatively for sugar.

Significance. An excretion of more than 3 Gm. of sugar may indicate intrahepatic jaundice.

HIPPURIC ACID TEST

Purpose. To determine the ability of the liver to synthesize hippuric acid from benzoic acid.

Test Diet. A light breakfast consisting of toast and coffee is given.

Procedure. One hour after breakfast give 6 Gm. of sodium benzoate dissolved in 30 cc. of water and follow with 100 cc. of water. Collect urine specimens hourly for 4 hours, and determine the hippuric acid excretion.

Significance. Excretion of less than 3 Gm. of hippuric acid indicates liver impairment — catarrhal jaundice, hepatitis of various forms, cirrhosis.

KIDNEY FUNCTION TESTS

CONCENTRATION TEST

Purpose. To measure the ability of the kidney to concentrate urine.

Test Diet (Modified Volhard and Fahr).[2] A weighed diet is served in three meals. No other food and no fluids are allowed during the test.

Breakfast

	Gm.
Toast	60
Butter	15
Jelly	30

Luncheon

	Gm.
American cheese	50
Crackers	30
Butter	20
Jelly	30

Dinner

	Gm.
Meat, lean	50
Potato, baked	100
Bread	30
Butter	20
Jelly	30

Procedure. The urine is collected in separate containers at 11 A.M., 2, 5, and 8 P.M., and 8 P.M. to 8 A.M. The specific gravity of each sample is determined.

Significance. The specific gravity of at least one sample of urine should be 1.025 or greater. If it is less, kidney impairment is indicated.

DILUTION TEST

Purpose. To determine the ability of the kidney to excrete fluids.

Procedure. Omit breakfast. Discard the morning urine specimen and give 1500 cc. of water at 8 A.M. Collect urines in separate containers at 8:30, 9:00, 9:30, 10:00, 10:30, 11:00, 11:30 A.M., 12 noon, and 12 noon to 8 A.M. Determine the specific gravity of each sample.

Significance. The total volume of urine excreted should be 80 to 120 per cent of the intake. The specific gravity of at least one sample should be as low as 1.003. A lower quantity than that indicated above and a consistently higher specific gravity are indicative of kidney impairment.

TEST MEAL FOR KIDNEY FUNCTION

Purpose. To measure variations in specific gravity and the volume of urine on a prescribed diet.

Test Diet. The following diet was prescribed by Mosenthal of the Johns Hopkins Hospital. It is no longer thought necessary to weigh the foods for the diet; in fact, the patient may be allowed

the usual choice of foods just so long as a pint of fluid is included at each meal, and so long as no fluids are taken outside of the meals until 8 o'clock of the following morning. The diet given here is the original diet proposed by Mosenthal:[3]

MENU

Breakfast, 8 A.M.

	Weight	Approx. Measures
Boiled oatmeal	100 gm.	½ cup
Sugar, 1 to 2 tsp.		
Milk	30 cc.	2 tbsp.
2 slices of bread	30 gm. each	2 slices 3½″ × 3″ × ½″
Butter	20 gm.	4 tsp.
Coffee, 160 cc.	200 cc. (Coffee, Sugar, Milk)	⅔ cup
Sugar, 1 tsp.		
Milk, 40 cc.		2 tbsp. plus 2 tsp.

Dinner — Noon

	Weight	Approx. Measures
Meat soup	180 cc.	¾ cup
Beefsteak	100 gm.	2 pcs. 2½″ × 2½″ × 1″
Potatoes, boiled, mashed or baked	130 gm.	⅔ cup
Green vegetables as desired		
2 slices bread — each	30 gm.	2 slices 3½″ × 3″ × ½″
Butter	20 gm.	4 tsp.
Tea, 180 cc.	200 cc. (Tea, Sugar, Milk)	¾ cup
Sugar, 1 tsp.		
Milk, 20 cc.		1 tbsp. plus 1 tsp.
Water	250 cc.	1 cup plus 2 tsp.
Pudding, tapioca or rice	110 gm.	

Supper, 5 P.M.

	Weight	Approx. Measures
2 eggs cooked any style		
2 slices of toast — each	30 gm.	2 slices 3½″ × 3″ × ½″
Butter	20 gm.	4 tsp.
Tea, 180 cc.	200 gm. (Tea, Sugar, Milk)	¾ cup
Sugar, 1 tsp.		
Milk, 20 cc.		1 tbsp. plus 1 tsp.
Fruit, stewed or fresh		1 portion
Water	300 cc.	1 cup plus 4 tbsp.

8 A.M. No food or fluid is to be given during the night or until 8 o'clock next morning (after voiding), when the regular diet is resumed.

Patient is to empty bladder at 8 A.M. and at the end of each

period as indicated below. The specimens are to be collected for the following periods in properly labeled bottles:

8 A.M. to 10 A.M.; 10 A.M. to 12 noon; 12 noon to 2 P.M.; 2 P.M. to 4 P.M.; 4 P.M. to 6 P.M.; 6 P.M. to 8 P.M.; 8 P.M. to 8 A.M.

Significance. The volume of the night urine should be much less than that of the day collections. Nocturnal polyuria suggests renal impairment. The maximal specific gravity of the day urine samples should exceed 1.018. The difference between the highest and lowest specific gravity should be at least 8 to 9 points.

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SECTION IV

Practical Applications of Nutrition

Elementary Cookery

CHAPTER XXXVII

Introduction to the Study of Elementary Cookery

The value of a knowledge of nutrition is measured in part by the ability of the student to apply the principles learned in the daily planning, preparation, and service of meals. To be able to select and prepare even a simple and nourishing meal is not a haphazard affair, but involves many different methods and a multiplicity of detail both of which call for careful training in the science and art of cookery.

The student should learn to select, prepare, and serve simple nourishing meals with regard to:

1. Attractiveness and convenient arrangement of tray
    a. Choice of covers, napkins, china, glassware, and silver
    b. Cleanliness
    c. Orderly arrangement
    d. Pleasing colors
    e. Size of portions
2. Palatability of food
    a. Flavor combinations
    b. Appropriate seasonings
    c. Texture
    d. Temperature
3. Nutritive value
    a. Inclusion of foods containing the nutritive essentials
    b. Methods of cookery to retain maximum food value
4. Appropriate timing
    a. Trays served on time
    b. Time conserved for patient care
5. Economy

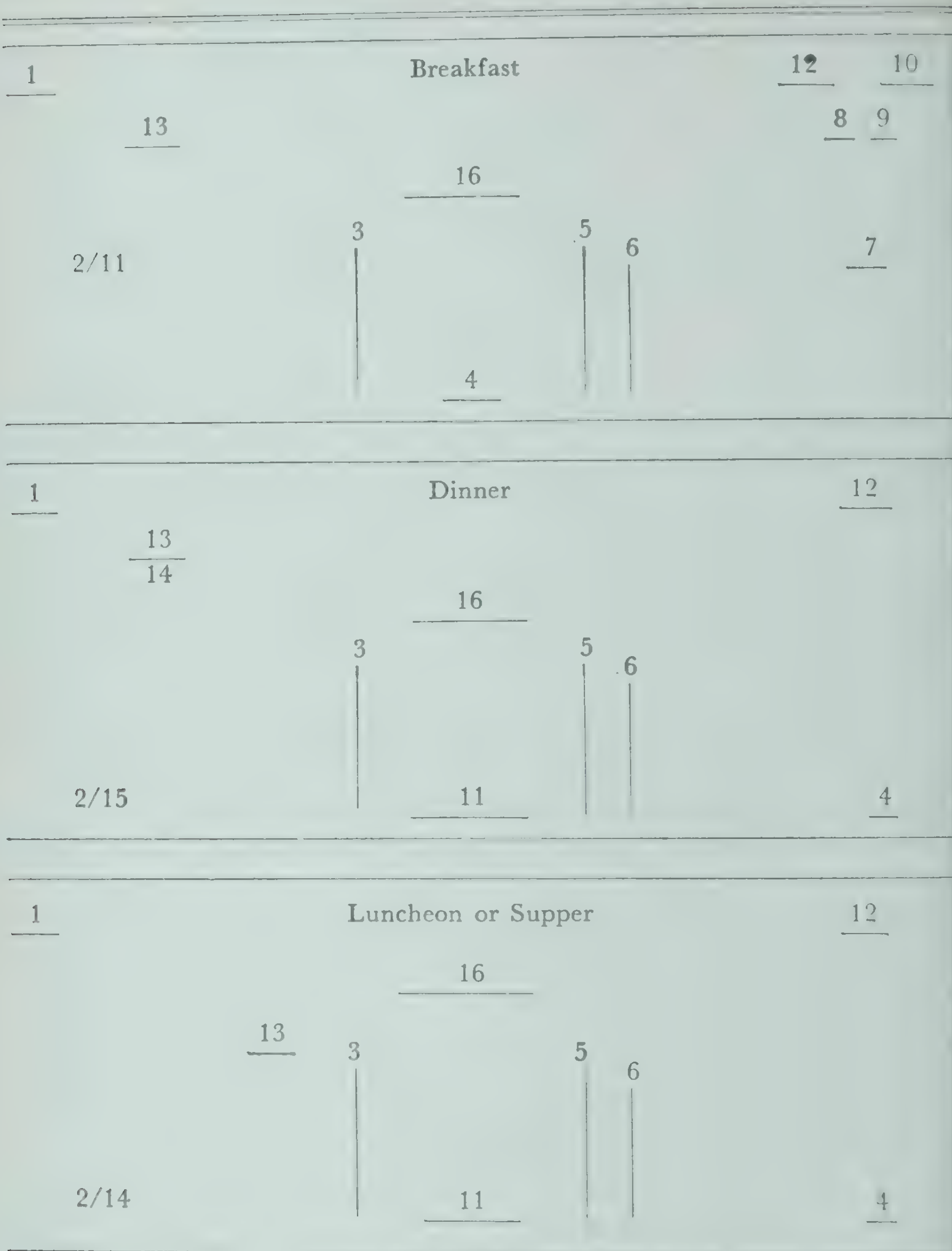


Fig. 37.

1. Bread and butter plate
2. Napkin
3. Fork
4. Fruit or dessert
5. Knife
6. Spoon
7. Cup and saucer
8. Sugar bowl
9. Creamer
10. Coffee- or teapot
11. Cereal, soup, or cocktail
12. Milk or water glass
13. Salt and pepper
14. Vegetable
15. Salad
16. Main plate

The chapter discussing each class of food in turn should be studied thoroughly before preparation of that class of foods is undertaken. The methods of cookery and the directions for the use of recipes on pages 579 to 581 inclusive, must be read carefully before any cookery is attempted.

Instructions for Work. It is required that the student learn to observe good working habits, such as:

1. Wash hands with soap and water before beginning any food preparation.
2. Assemble all materials and utensils before beginning to work.
3. Always use a utility plate for carrying materials from supply table to the desk.
4. Take from the supply table only the exact measure of food needed; do not waste materials!
5. Use as few utensils and dishes as possible; measure dry materials first, then liquids to save time in washing dishes.
6. Put pans to soak as soon as they have been used; use cold water for dishes in which protein foods have been cooked, and hot water for dishes which are greasy or which have been used for starch cookery.
7. Wash dishes at the desk using plenty of hot, soapy water; rinse dishes with hot, clear water.
8. Check desks each day for cleanliness and proper placement of equipment.
9. Return equipment taken from cupboards.
10. Perform housekeeping duties as assigned by the instructor:
    a. Clean refrigerator.
    b. Clean stoves.
    c. Clean sinks and drainboards.
    d. Put away food supplies, and clean supply tables. Wash containers, and clean cupboards as necessary.
    e. Distribute clean towels, cloths, etc., at the beginning of the class; count soiled laundry at the end of the period.
11. Read directions for food preparation carefully before beginning work!

Laboratory Equipment. The usual laboratory equipment will be found to include:

1. Students' desks
   a. Working space including bread and chopping boards
   b. Two burner gas or electric hot plates
   c. Stool
   d. Drawers for individual equipment:

Knife	Juice extractor
Fork	Utility pan
2 tablespoons	Small double boiler
1 soup spoon	2 small saucepans with covers
2 teaspoons	Nest of mixing bowls
1 iced tea spoon	2 small baking pans
Set of measuring spoons	Small flour sifter
Measuring cup	Small frying pan
Salt and pepper shakers	Dish mop
Custard cup	Vegetable brush
Ramekin	Dish pan
2 strainers, large and small	Dish rack
2 egg beaters, rotary and flat	Soap dish
Wooden spoon	Matches
Paring knife	
Case knife	
Case fork	
Spatula	
Asbestos mat	
Hot pot holder	

2. Cabinet for china and glassware

Tall beverage glasses	Dinner plates
Water glasses	Luncheon plates
Fruit juice glasses	Salad plates
Sherbet cups	Bread and butter plates
Individual creamers	Sauce dishes
Individual sugar bowls	Cereal bowls
Coffeepots and teapots	Soup bowls
	Cups and saucers

3. Cabinet for other supplies used daily:

Trays	Dish towels
Tray covers	Dish cloths
Napkins	

4. Cabinet for supplies used occasionally. Some will be used by each student and some may be used by several:

Toaster	Coffee pots
Meat chopper	Colanders

Purée mill with wooden masher	Graters
Potato mashers	Rolling pins
Muffin tins	Ice cream freezer
	Diabetic scales

5. Ovens: preferably an oven for every two students
6. Refrigerator
7. Tables for supplies
8. Storage space for supplies

CHAPTER XXXVIII

Beverages

A beverage is any material used as a drink for the purpose of relieving thirst and introducing fluid into the body, nourishing the body, and stimulating the individual. Beverages are composed chiefly of water, with other ingredients added to give flavor, increase nutritive value, and introduce stimulants.

Classification. Beverages may be classified according to their function in the body:

1. Refreshing
   a) Water, plain or carbonated
   b) Gingerale and other bottled beverages
   c) Fruit juices and fruitades
   d) Iced tea
2. Nourishing
   a) Milk: raw, pasteurized, skimmed, evaporated, malted, buttermilk, acid milks, chocolate, cocoa
   b) Eggs: eggnog made with whisky, rum, brandy, fruit juices, coffee, chocolate
   c) Albuminized fruit juices
   d) Fruit juice with whole egg
   e) Glucose lemonade or orangeade
3. Stimulating
   a) Eggnogs made with whisky, rum, brandy, or a combination of these
   b) Coffee
   c) Hot tea

Ingredients in Beverages. There are a number of food materials which can be used singly or in combination as beverages. Those which are most frequently used will be discussed here.

Milk is the most important of all the liquid foods since it gives more protection than any other food for the money spent. Its mild flavor permits its use in a great number of ways. It may be served

plain or acidulated; it may be reinforced with egg, glucose or lactose, gelatin, yeast, or dried milk, depending upon the type of nutrient needed; and it may be flavored with chocolate, coffee, or other flavorings.

Eggs may be used whole in eggnogs or hot broth. Eggnogs in which whisky or other forms of alcohol are used constitute the most important of the stimulating beverages. Eggnog made with strong coffee is only mildly stimulating, but lends variety to the general liquid diets. Fruit eggnogs are not stimulating, but are among the most nourishing of the egg drinks since they contain not only whole egg but also cream and possibly milk and glucose in addition to the fruit juice. Fruit eggnog differs from fruit juice and egg inasmuch as the latter contains no cream or milk. Albuminized fruit juices are made with the white of egg only. They may be so prepared that the egg albumin is not perceptible, or the egg white may be beaten stiff and folded into the fruit juice.

Fruit juices not only are pleasantly refreshing but they are nourishing as well. The citrus juices are excellent for their ascorbic acid content. Fresh or canned juices may be served plain or sweetened; they may be reinforced with egg white or whole egg. The following fruits are some of those which are used for their juice:

1. Citrus: oranges, lemons, grapefruit, limes
2. Berries: strawberries, loganberries, blackberries, raspberries
3. Tree fruits: pear, peach, apricot, plum, prune, apple
4. Other fruits: pineapple, grapes, tomatoes

Chocolate is the paste made by mashing the fermented and roasted *Cacao bean*. The paste is molded and sold as bitter chocolate. It contains approximately 50 per cent fat and some protein and carbohydrate. A mild stimulant, theobromine, is present in chocolate. Sweet chocolate contains added sugar, while milk chocolate consists of chocolate, milk, and sugar. Chocolate is important primarily as a flavoring adjunct but it does have food value as well. A double boiler should be used for melting it since scorching occurs readily.

Cocoa is the ground product of the cacao bean after some of the fat has been removed. By government regulation "breakfast cocoa" must contain not less than 22 per cent fat, although cocoa not so labelled may contain as little as 8 per cent fat. Cocoa powder

should be boiled with water before adding milk in order to cook the starch and develop the flavor.

Coffee is the bean of the coffee plant which grows in tropical countries. As a rule it is imported in the green form and roasted before it is sent to the retail market. Occasionally a connoisseur prefers to have the coffee roasted at home under supervision, and ground just before the beverage is to be made. Coffee alone has no food value, but it does furnish a certain amount of stimulation because of the caffeine which raises the blood pressure, stimulates renal activity, and momentarily masks fatigue. Tannin may interfere with digestion. As a rule a cup of coffee contains 1.5 to 2.5 grains of caffeine, depending upon the strength of the brew. The amount of tannin in coffee also depends upon the method of preparation, since it is soluble in hot water; the longer coffee is brewed the greater will be the tannin content. Coffee which is boiled a long time and left standing on the grounds will have a bitter flavor. Bitterness is increased if the coffee is combined with such substances as chicory. French coffee has a high percentage of chicory.

The aromatic oils, especially caffeol, give to coffee its characteristic flavor and aroma. Caffeol is volatile and it is rapidly lost from ground coffee which is exposed to the air. The purchase of the whole coffee bean and subsequent grinding just before the beverage is to be brewed is ideal but not always practical. The use of vacuum packed coffees is a great aid in preserving coffee aroma and flavor. Ground coffee should be kept in a tightly covered tin and used within a short time after its purchase.

Coffee may be obtained in different types of grind: (1) pulverized which is used in the preparation of drip coffee; (2) steel cut or percolator coffee; (3) coarsely ground coffee which is the type used when boiling is the method of preparation.

The best utensils for making coffee are made of glass, porcelain, or granite. Freshly boiled water should always be used. There are three methods for the preparation of coffee.

Drip coffee is made in a pot containing some type of filter, usually a muslin bag, or a filter paper. Boiling water is poured once over the pulverized coffee. Pouring coffee over the grounds a second time results in loss of caffeol. Drip coffee contains the least amount of caffeine and retains the greatest amount of caffeol.

Percolated coffee is extracted below the boiling point and contains slightly more caffeine than drip coffee.

Boiled coffee should correctly be steeped. The ground coffee is added to the boiling water and allowed to steep for two to three minutes. It contains more caffeine and tannin than either drip or percolated coffee.

Soluble coffee is made from pure coffee which has been pulverized and concentrated. It is soluble in hot or cold water or milk. Such coffee is used in small quantities, usually one half to one teaspoon of the powdered coffee to one cup of hot or cold water being sufficient. Extraction of caffeine and tannin is high, but the amount in the finished beverage will depend upon the amount of coffee used.

Coffee substitutes, or cereal coffees, are made from a combination of roasted grains. Such substitutes contain no caffeine or tannin and therefore furnish no stimulation save that which is derived from the heat of the beverage.

Tea is obtained from the leaves and flowers of the tea bush which grows in subtropical China, India, and Japan. A great variety of teas are available on the market. The top tiny leaves and buds or flowers at the end of the shoot furnish the choicest and most expensive brands, designated as flowery pekoe. Orange pekoe, the most commonly marketed tea, is the first and second leaf just below the buds. Pekoe and Souchong teas are of poorer quality.

The kind of tea is determined by its treatment subsequent to picking. Green tea undergoes no fermentation process, and is light in color and rich in tannin. Black tea is fermented, dark in color, and has lost some of its tannin. Oolong tea is an intermediate product between the black and the green teas.

To obtain the best results tea should be made in a preheated pot of earthenware or glass. It should be made with freshly boiled water and steeped from three to five minutes according to the strength desired. Tea should never be allowed to stand long in contact with the leaves, since such treatment permits too great extraction of tannin which cause the finished product to be bitter and unpalatable. Under no circumstances should tea be permitted to boil.

The amount of theine (a stimulant like caffeine) extracted is less in the usual American brew than the amount of caffeine in a like

amount of coffee. This explains the relatively greater stimulating effect of coffee. The cloudiness of some iced tea is due to the precipitation of tannin and is an indication of too long a period of steeping.

Preparation of Beverages. In preparing and serving beverages the following points should be kept in mind:

1. Fruit beverages must be sufficiently tart to be refreshing. The addition of a little lemon juice to the sweet fruit juices will give them character. Tart juices do not require this addition.

2. Cold beverages must be ice cold, not cool or warm.

3. Beverages must not be diluted too much either with water or with ice.

4. Glasses should be selected for the amount of juice to be served; that is, small glasses should be used if only 100 cc. are to be served rather than using a large tumbler and half filling it.

5. If quantities of beverages are to be prepared it may be time saving to prepare a standard syrup using sugar and water, which may be used for all beverages.

6. Beverages may be garnished with fresh uncrushed mint leaves, sliced orange, lemon, or pineapple, maraschino cherries, or ices.

Detailed methods and recipes for the preparation of beverages will be found in the section beginning on page 582.

PROJECTS

1. Calculate the protein, fat, carbohydrate, calories, calcium, iron, and vitamins of the recipe for cocoa. What changes occur if 100 cc. of milk are replaced by 100 cc. of coffee cream?

REVIEW QUESTIONS

1. What are three functions of beverages?

2. Name the foods commonly used in the preparation of beverages.

3. List six different ways in which milk may be flavored or reinforced.

4. What is the essential difference between chocolate and cocoa? How does this affect the principle of cookery?

5. What stimulants are present in coffee? In tea? What is their physiological action?

6. Describe three methods for the preparation of coffee. Discuss the relative merits of each.

CHAPTER XXXIX

Milk

Milk is considered to be our most nearly perfect food because it contains all of the essential building stones for growth and maintenance of the body tissues as well as available calcium, phosphorus, and vitamins. That it is not entirely perfect is indicated by the fact that it must be supplemented by other foods in the diet of infants shortly after birth in order that dietary deficiencies may be avoided.

Milk may be defined as the "whole, fresh, lacteal secretion obtained from the complete milking of one or more healthy cows." The milk of various mammals is used for food depending upon the availability of the milch animal. Cow's milk is by far the most common and will be discussed here.

Composition. Fresh cow's milk is approximately 87 per cent water and 13 per cent solids. It is composed of 3.5 per cent protein; 3.9 per cent fat; 4.9 per cent carbohydrate; 0.12 per cent calcium; 0.09 per cent phosphorus; 0.00002 per cent iron; 0.00002 per cent copper; and other minerals to make a total ash content of 0.75 per cent. The vitamins per 100 grams of pasteurized milk are: 170 I.U. of vitamin A; 0.3 to 4.4 I.U. vitamin D; 1.0 mg. ascorbic acid; 0.04 mg. thiamine; 0.18 mg. riboflavin; and 0.10 mg. niacin.

Grading of Milk. Government and medical regulations require that milk sold for consumption by the public must be routinely inspected for bacterial count and butter fat content. The regulations vary somewhat from state to state, and even from city to city. They usually include standards of health for all milkers, and observations of rules for sanitation of utensils, barns, and personnel. Only milk from healthy cows may be sold.

Certified milk has the highest rating for purity and cleanliness and is produced and marketed under very strict supervision of a medical board. At the time of delivery to the consumer it must

contain fewer than 10,000 bacteria per cc. when raw, and less than 500 bacteria per cc. when pasteurized. The stringent regulations for its production increase markedly the cost so that it is not available for general use. It is used primarily for the feeding of infants.

Grade A milk must be obtained from cows free from disease and at the time of delivery to the consumer it must have a bacterial count of less than 10,000 per cc. for pasteurized milk. Grade A milk has a specified butterfat content.

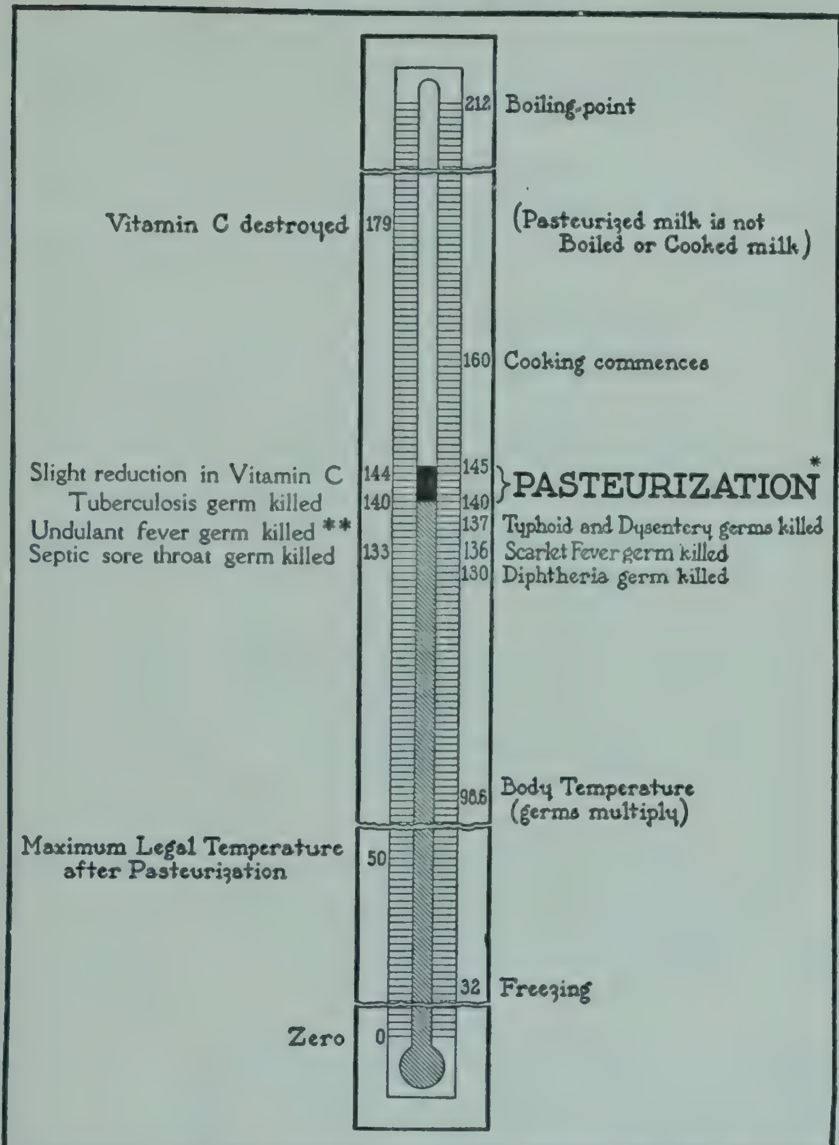
Grade B milk must always be pasteurized and should contain not more than 50,000 bacteria per cc. This grade of milk cannot be sold for human food in some states.

Making Milk Safe. There are a number of milk-borne diseases and for this reason the production and marketing of milk in this country is subjected to the aforementioned inspection. The diseases which may be spread by milk are tuberculosis, scarlet fever, typhoid fever, diphtheria, undulant fever, septic sore throat, epidemic arthritic erythema, and foot and mouth disease. In order that these diseases may not menace the public certain processes have been instituted to obviate the danger; namely, pasteurization and sterilization. Pasteurized milk is milk that has been subjected to a temperature of 140° to 145° F. and held at that temperature from 20 to 30 minutes. Sterilized milk must be brought to the boiling point, 212° F., and held there for a specified time. Pasteurization does not change the color or flavor of the milk, while sterilization deepens the color and gives to the milk a slightly caramelized taste.

Milk must be properly handled in the home as well to insure its safety. As soon as possible after delivery, milk should be put in the coldest part of the refrigerator. The bottle or container in which it has been pasteurized is the best utensil for storing it. Fresh and old milks must not be mixed, since spoilage will more quickly occur in the whole lot. It is important to remember that evaporated milk requires the same care as fresh milk, for once the can has been opened it is subject to the same spoilage factors.

Types of Milk Used. Milk may be purchased as whole fresh liquid milk, skimmed milk, buttermilk, evaporated milk — plain or irradiated, condensed milk, and dried whole, skimmed, or protein milk. It is also possible to obtain cultured milk or milk which has been fermented by the addition of lactic or citric acid, Bulgarian or

HOW PASTEURIZATION SAFEGUARDS YOUR MILK SUPPLY



*"Pasteurized milk" is natural cow's milk not more than seventy-two hours old when pasteurized, subjected for a period of not less than thirty minutes to a temperature of not less than one hundred and forty, nor more than one hundred and forty-five degrees Fahrenheit, and immediately thereafter cooled to a temperature of fifty degrees Fahrenheit or lower.

***Pasteurization for not less than 30 minutes at 140° F.*

Fig. 38.

acidophilus bacteria. Fresh milk may be modified by homogenization, irradiation, and acidification.

Homogenized milk is fresh milk which has been pasteurized and subjected to a process which breaks up the solid constituents into very fine particles and mixes them so completely as to make it impossible for the fat to rise as cream.

Irradiated milk is milk to which vitamin D has been added by irradiation of the milk itself, irradiation of the cow, or the use of concentrates.

Acid milk is produced by the addition of lactic or citric acid to milk in order to render it more easily handled by those who cannot tolerate whole diluted sweet milk. It has been used successfully by many pediatricians since it furnishes a milk which needs little if any dilution and therefore supplies more calories per ounce than milk which has been greatly diluted. Cultured milks are used for the feeding of infants and occasionally for invalids.

Evaporated milk is the product obtained from fresh whole milk after about half of the water has been removed. During the process the protein is changed to a certain extent so that softer finer curds form in the stomach during digestion. It is wholesome, easily digested, free from bacteria until the can is opened, and lends itself particularly well to the preparation of infant formulas. When diluted to its original volume with water it has a composition like that of whole sweet milk. Evaporated milk may be increased in vitamin D content through irradiation, the number of vitamin units contained therein being controlled by government regulations.

Condensed milk is reduced in its water content to a greater extent than evaporated milk. It owes its keeping qualities to its high sugar content (about 40 per cent) rather than to the application of heat. It is used as an emergency measure in the feeding of infants but owing to its high sugar content it must be diluted for use to such an extent that its other constituents have been reduced too low to be able to meet the needs of the infant.

Dried milk, whole or skimmed, results from the removal of most of the water from fresh milk. It is prepared by passing milk in thin layers over heated surfaces in vacuo, or by spraying partially evaporated milk into warm dry air. It comes in finely powdered form and may be easily reconstituted to its original composition. Four

and one half ounces of dried milk are equal to one quart of fresh milk. Dried milks are easily stored and transported. They should prove to be valuable for families who have no refrigeration. Moreover, they can be readily disguised in foods for those who object to drinking liquid milk as such.

Importance of Milk in the Diet. There is no adequate substitute for milk. Not only does it supply the best type of building material for growth and maintenance of the body tissues, but it is our most available source of calcium. The iron content of milk is not high, but practically all of that present is completely utilized to the best advantage. Lack of bulk and low ascorbic acid content are reasons why milk comes short of being a perfect food.

The superiority of milk protein over other proteins for the support of growth has long been known. Milk supplements cereal proteins in an excellent fashion for it supplies the amino acids lysine and tryptophane which are lacking in the cereals. Milk thus becomes the most important single item of food throughout the growth period of infants, childhood, adolescence, as well as in pregnancy and lactation. During the latter period milk not only proves to be the best material for the building of human milk, but is also the surest means of safeguarding the body protein of the mother during the nursing period.

The amount of milk recommended for daily consumption is: one and one half pints to one quart daily for infants and children; one to one and one half pints daily for the average adult; one quart for the pregnant woman; and one and one half to two quarts for the nursing mother.

Digestion and Utilization of Milk. The enzyme rennin coagulates the milk in the stomach and separates it into two parts; namely, the curds and the whey. The curd or the solids are made up of casein, fat, the fat-soluble vitamins, and some of the minerals. The whey is made up of water, lactalbumin and lactoglobulin, lactose, some of the minerals, and the vitamins of the B complex. All of the proteins of milk are partially digested in the stomach. The finer the curd the more rapid will be the digestion and absorption. Evaporated and boiled milks contain finer curd than raw milk. The digestion of milk is completed in the intestine where the end products of protein digestion are the amino acids, and the lactose is split to

galactose and glucose. The fat of milk is very finely divided and is acted upon to a small extent by the lipases in the stomach, although most of the digestion of fats occurs in the small intestine.

Milk digests completely and leaves no residue. In itself it is neither laxative nor constipating in its effect, nor does it tend to produce distention as erroneously believed by many. Boiled milk is no more constipating in its effect than fresh raw milk; however, the boiling of milk does destroy bacteria which may be troublesome in certain cases of diarrhea.

Intolerance to Milk. There are individuals who show an inability to take milk without reacting unfavorably in one way or another, but the number is not as great as we would be led to believe. Experience, with children especially, has proved that many of the so called allergies for milk are not allergies at all, but a dislike on the part of the individual for the taste, color, or odor of milk. Other dislikes may be traced to prejudice of some other member of the family who has refused to drink milk. It is a simple matter to prove whether a real allergy exists by introducing milk into the diet in a form not recognizable to the individual. An intolerance for milk is most unfortunate, because it is difficult to feed either a child or an invalid a diet which is adequate without the use of this most valuable food.

Ways of Using Milk in the Diet. Milk is a basic food material for the preparation of both liquid and solid foods in the dietary. As a beverage it furnishes one of the best carriers for the reinforcing agents since its mild flavor makes it easy to add egg white or whole egg, cream, chocolate, glucose or lactose, and bottled beverages. It is thus possible to vary the liquid diet acceptably. Milk soups made with a white sauce and puréed vegetables as well as chowders furnish important additions to the diet, while custards, milk puddings, junket, ice cream, and milk sherbets add materially to the palatability of the diet.

Principles of Cookery. The scalding of milk as practiced in the preparation of many dishes changes the flavor of the milk. Since albumin sticks readily to the sides and bottom of the pan, scorching will occur readily and therefore a double boiler should be used. Milk should not be allowed to boil, except where boiling becomes necessary for sterilization of the milk.

PROJECT

1. List the protein, fat, carbohydrate, caloric, calcium, phosphorus, iron, and vitamin values for 100 grams of fresh, dried, and evaporated milk. Calculate how much evaporated milk is necessary to replace the protein of 100 grams of fresh milk. How much dried milk would be necessary?

REVIEW QUESTIONS

1. Define milk. Name some animals other than cows from which milk may be obtained.

2. Give the composition of milk. Name the constituents which make milk of outstanding importance in the diet of infants and children.

3. Why is milk not a perfect food?

4. How is milk graded? What is the purpose of grading milk?

5. Name the measures for making milk safe for human consumption.

6. Name the milk-borne diseases. At what temperature are tubercle bacilli rendered harmless? At what temperature are the bacteria causing undulant fever destroyed?

7. Name the different types of milk which may be purchased. Give the characteristics of each.

8. How much milk should a child of one year of age drink during the day? An adolescent boy or girl?

9. Why is an adequate amount of milk advisable for pregnant women and nursing mothers?

10. Name five ways in which milk may be used in the diet.

CHAPTER XL

Eggs

Nutritive Value. Eggs rank next to milk in their value as a food. They contain protein and fat of superior quality and an abundance of minerals and vitamins. Since the yolk and the white of egg differ in several respects, it is of interest to compare the composition of the two parts.

COMPOSITION OF EGGS

	Whole per cent	Yolk per cent	White per cent
Water	74.0	49.4	87.8
Protein	12.8	16.3	10.8
Fat	11.5	31.9	0
Carbohydrate	0.7	0.7	0.8
Calcium	0.058	0.157	0.011
Phosphorus	0.224	0.538	0.015
Iron	0.0027	0.0076	0.0001

It will be noted from this table that egg white is primarily a solution of the protein, ovalbumin, sulfur being the important mineral. The yolk is rich in protein (ovovitellin), highly emulsified fat, phosphorus, calcium, iron, vitamin A, thiamine, and riboflavin.

Place in the Diet. Eggs are such a valuable contribution to the diet that they should be used in some form every day with a minimum of four eggs weekly. Hard and soft cooked eggs are equally well digested, and are completely absorbed, leaving little if any residue in the intestinal tract.

Selection and Care. New-laid or day-old eggs, fresh eggs, and cold-storage eggs are the classifications under which they are offered to the public. New-laid or day-old eggs are self-explanatory, fresh eggs are those slightly older than the best quality, while cold-storage eggs are those kept fresh by refrigeration. These last, if carefully handled, are wholesome, and they are much more economical than new-laid or "fresh" eggs. They can be used for most cooking pur-

poses with the exception possibly of poaching, which calls for very fresh eggs. Freezing and drying are new methods of preservation, and no doubt the general public will soon be able to purchase them in these forms.

All eggs are graded in two ways: according to (1) external characteristics, such as weight, color, uniformity of size, and condition of the shell (clean, cracked, etc.); and (2) the internal quality. The latter takes into consideration the size and condition of white and yolk and the condition of the germ spot. The internal condition of the egg is determined by candling, a process whereby light is concentrated on the shell so that its content is thrown into relief. Eggs must be discarded when they show a dark spot or blood in the yolk. The best quality eggs are new-laid.

As an egg becomes old the white becomes watery and the water content of the yolk increases. These changes result in eggs which do not poach well, and in which separation of the yolk and white is difficult. Since a warm temperature accelerates the deterioration, it is important to keep eggs in a cool clean place away from all odors.

Ways of Using Eggs. Only the chief ways of using eggs will be mentioned here:

1. As reinforced beverages: eggnogs, shakes, etc.
2. As breakfast dishes: soft, coddled, scrambled, poached, as omelets, etc.
3. As luncheon or supper dishes: soufflés, baked, scalloped, in combination with cheese, etc.
4. As hearty salads
5. As sandwich fillings
6. As desserts: custards, soft, baked or frozen; in fruit whips (white only).

Eggs may be used as thickening agents, as binders, as leavening to give lightness to the flour mixtures.

Examples of the thickening power of eggs may be seen in custards, and in sauces, one egg being equivalent to one tablespoon of flour in thickening power. When used for thickening custards, the egg should be beaten just enough to mix.

For binding, eggs are added to stuffing for meats and poultry and are used in making noodles and meat loaves.

The leavening power of eggs is demonstrated in the making of

sponge cake, popovers, and soufflés. In beating eggs, much air is incorporated; when the batter is baked this air expands and lightens the finished product. This leavening power of eggs is increased when the whites and yolks are beaten separately.

Eggs are used as an emulsifying agent in the preparation of mayonnaise. Each droplet of oil is coated with a thin film of egg protein to form a semi-permanent emulsion.

Cookery of Eggs. The temperature at which eggs are cooked determines the tenderness, texture, and attractiveness of the finished product.

Egg white is largely composed of albumen. This substance begins to coagulate at 134° F. (changes from the raw state to a tender jelly-like substance) and solidifies at a temperature of 160° F. When the temperature is increased to the boiling-point (212° F.), the albumen becomes tough and unpalatable. The yolk of the egg cooks at a slightly lower temperature than the white.

It is important to remember that a simmering temperature should therefore be used for soft, hard, and poached eggs. A slow oven should be used for the cooking of all egg dishes such as baked custards and soufflés, and a double boiler is essential for the preparation of soft custards.

The leavening effect of egg white depends on the amount of air incorporated during the beating. The whites should be beaten until they are stiff but not dry. They are folded into other mixtures carefully to avoid breaking the air bubbles. A low heat during the cooking of products leavened in this manner is essential.

PROJECTS

1. Compare the nutritive value of one egg white (35 grams) with one egg yolk (18 grams). Give the values for protein, fat, calories, calcium, phosphorus, iron, vitamin A, thiamine, and riboflavin in chart form.

2. Give the principles and methods of preparation for: poached egg, soft cooked custard, foamy omelet, scrambled egg, and soft cooked egg. Refer to the recipe section for details.

3. Calculate the food value of one portion of poached egg on buttered toast.

4. Obtain prices of various grades and sizes of eggs in local markets, and discuss the relative economy of each.

REVIEW QUESTIONS

1. What factors determine the grading of eggs?
2. What changes occur in eggs with age?
3. In what ways may eggs be preserved?
4. At what temperature does the coagulation of egg protein begin?
5. What factors were probably overlooked if the following products were obtained:
   a. Watery baked custard?
   b. Hard, dry, scrambled eggs?
   c. Cheese soufflé which cracked and fell immediately after removing it from the oven?
   d. Egg white which would not whip?
6. Why must egg whites be "folded in"?
7. Name five ways in which eggs may be included in the menu.

CHAPTER XLI

Cereals

Cereals derive their name from Ceres, the goddess of agriculture and harvest. No other foodstuff has had the wide cultivation of the cereal grains; in fact, there are few countries in which grains of some kind cannot be grown. Cereal grains belong to the grass family whose fruit or seed may be used for food.

Cereals as an economical source of energy are not surpassed by any other food material. Not only is their carbohydrate content high, but the cost of production and transportation, as well as their good keeping qualities, make them within the financial reach of practically everyone. A series of studies[1] made of typical American families from both urban and country communities showed that of the total money spent for food only 18 per cent was spent for cereals and breadstuffs. At the same time the latter furnished approximately 38 per cent of the total calories, 37 per cent of the protein, 37 per cent of the phosphorus, and 25 per cent of the iron supplied by the diet.

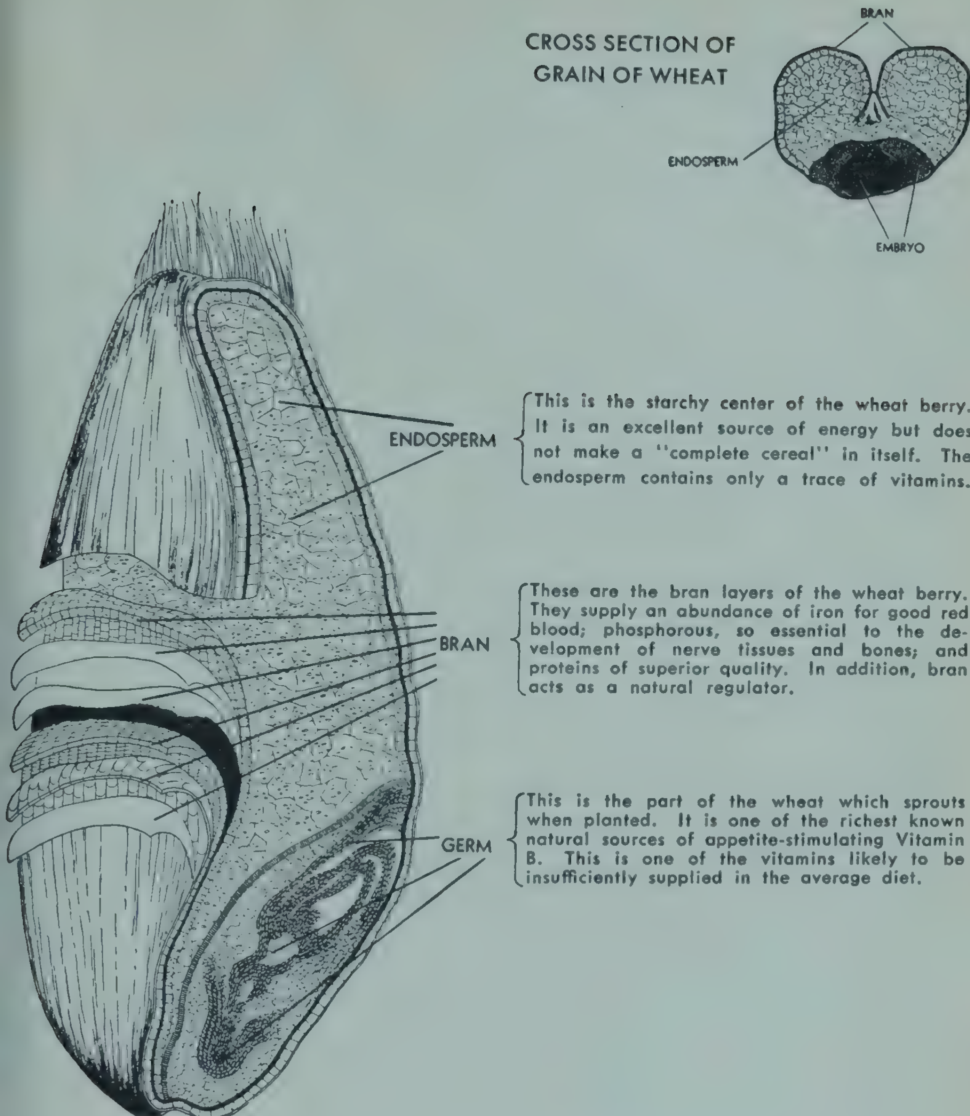
Types of Cereal Grains Used. The grains most commonly used for food are wheat, corn, oats, rice, rye, and barley. Wheat and its products are used more extensively than the other grains in this country, although rice leads all others in world consumption.

Structure of the Whole Grain. The seed or kernel is divided into four parts:

(1) Bran, comprising about 5 per cent of the grain, is a hard fibrous material, cellulose, which covers the grain in a number of layers. Associated with the bran are minerals, especially iron and phosphorus, and vitamins of the B complex.

(2) Aleurone, lying close beneath the bran layers and making up about 8 per cent of the seed, consists of rectangular protein cells.

(3) Embryo or germ, approximately 5 per cent of the grain, is



Courtesy of the Ralston Purina Company

FIG. 39. THE NUTRIMENT IN A GRAIN OF WHEAT.

the part from which the grain sprouts. The embryo is rich in vitamins of the B complex, as well as iron and phosphorus.

(4) Endosperm, composed chiefly of starch cells in a network of protein, constitutes about 82 per cent of the entire grain.

Composition of the Whole Grain Cereals. *Cellulose,* approximately 2 per cent, occurs as the outer covering of the kernel and as the skeletal structure of the starch cells.

Carbohydrates, 68 to 79 per cent, occur chiefly as starch with some dextrins and sugars.

Protein, approximately 12 per cent, is inferior to animal proteins since some of the essential amino acids occur in very small amounts. The proteins of the whole-grain cereals are superior to those of refined cereals. The kind of protein contained in cereals determines the use in cookery; for example, the high gluten content of hard spring wheat makes it desirable for yeast bread, while soft winter wheat which contains less gluten is ideal for pastries and cakes.

Fat, about 2 per cent, is found almost entirely in the germ, and to a lesser extent in the bran layers. The presence of fat limits the keeping qualities of the cereal products; the richer the grain is in fat the shorter time it will remain fresh.

Minerals comprise approximately 2 per cent of the whole grain. Cereal grains furnish a fair amount of iron and phosphorus but are deficient in calcium.

Vitamins of the B complex including thiamine, riboflavin, and vitamin E occur abundantly in the germ.

Water constitutes about 10 per cent of the whole grain.

Enriched Flours and Bread. Only a small proportion of all bread eaten is of the whole grain variety. The milling of white flours results in loss of vitamins of the B complex and iron since the bran and germ containing most of these is not used. Since bread is such an important national food a program was instituted to restore these lost factors. A white flour or bread may be called enriched if it has sufficient vitamins and iron to meet the following standards:

	Per Pound of Flour mg.	Per Pound of Bread mg.
Thiamine	2.0 — 2.5	1.9
Riboflavin	1.2 — 1.5	1.6
Niacin	16 — 20	15
Iron	13 — 16.5	12

Digestion of Cereal Foods. Bran is broken down into finer parts, swells, absorbs and retains water in the intestinal tract, but is not affected by enzymic action, and does not contribute to the energy needs of the body. However, it furnishes essential bulk to stimu-

late the passage of the food mass down the intestinal tract. The starch cell, softened and released from the cellulose in cookery, is attacked by the enzymes of digestion, ptyalin in the mouth, amylopsin in the pancreatic juice, and finally the sugar-splitting enzyme of the intestinal juice, and changed to glucose, in which form it is absorbed.

Use of Cereal Grains and Their Products in the Diet. Cereals and breadstuffs, as already mentioned constitute the largest single source of energy in the diet. They are not only economical from a financial standpoint but also from the standpoint of effort on the part of the body, since they are absorbed and utilized almost completely. The bran of the whole grain carries with it some of the most valuable parts, and in addition furnishes the bulk needed in the diet for stimulating peristalsis in the intestinal tract.

The products of the grain used as food are:

A. Flours of all kinds including (1) wholewheat and graham flours both of which contain more or less of the entire grain; (2) white flour, highly refined and bleached, made up of the endosperm only; (3) white flour enriched with thiamine, riboflavin, niacin, and iron; (4) gluten flour composed largely of the proteins of wheat, this flour being richer in protein and lower in starch than other flours; (5) flours made from rye, corn, and barley, rye flour being used more extensively than that of corn or barley.

B. Breakfast cereals, either whole-grain, refined, or enriched which may (1) require cooking, as cracked wheat, oatmeal, or farina, or which are (2) ready to serve, as cornflakes, shredded wheat, puffed rice, or other combinations of oat and wheat flakes.

C. Cereal pastes such as macaroni, spaghetti, noodles.

D. Rice, white or polished, brown or unpolished, or wild.

Breakfast Cereals. The grocery store of today offers an almost unlimited selection of cereals for the breakfast table. There are those made of the entire grain, those which are highly refined and consequently of low vitamin and mineral value, and those which are refined but enriched with B vitamins and iron.

Uncooked cereals are more economical although they require a longer period of cooking to make them palatable. They are cheaper if bought in bulk, but one should note whether such products are stored in a sanitary manner in the grocery.

Many cereals are now partially cooked during the process of manufacture so that only a few minutes cooking time is required in the home. Ready-to-serve cereals may be obtained in great variety. They are the most expensive of the cereal foods, but require no time for preparation.

Cookery of Cereals. Cereals are cooked in order to soften or rupture the cellulose walls of the starch cells so as to render the starch more easily digested. The cooking of cereals also improves their flavor.

In the preparation of breakfast cereals it is necessary to use definite proportions of liquid to cereal in order to obtain satisfactory products. Starch cells absorb water, expand, and become more soluble on boiling. The dry cereal should be added to rapidly boiling salted water and cooked for a few minutes over a direct flame. Cooking is then continued in a double boiler to prevent sticking and burning. Whole-grain cereals should not be stirred while cooking as they are more palatable when the grains remain whole.

PROJECTS

1. Draw an outline of a cereal grain showing the structural parts. Indicate the nutrients contained in each part.

2. Tabulate the protein, carbohydrate, fat, calories, thiamine, and riboflavin in 100 grams of each of the following; oatmeal, puffed wheat, puffed rice, farina, cornflakes, and yellow cornmeal.

3. Calculate the number of servings of each of the above cereals one can purchase for 10 cents. Allow 20 grams of dry cereal for each serving.

REVIEW QUESTIONS

1. Give the approximate composition of cereals.
2. What contributions do cereals make to the daily diet?
3. What is meant by enriched flour? What other products are enriched? What are the reasons for an enrichment program?
4. Give three examples of (1) whole-grain cereals, (2) refined cereals, (3) enriched cereals.
5. State the principles of cooking cereals.
6. Why are the proteins of cereals of less biological value than protein from animal sources?

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CHAPTER XLII

Batters and Doughs

Bread, the largest single item in the average dietary, is produced in many forms. Loaf breads and quick breads are universally used throughout the world. They are made from flours or meals which have been manufactured from various grains, wheat being the type of flour most frequently used. Rye flour bread is popular in northern Europe and cornmeal bread is relished in Mexico and in the southern states of the United States.

Breads are made with either dough or batter. *Dough* is a soft mixture of flour, liquid, and other ingredients, the proportion of liquid being just sufficient to allow kneading or rolling into a sheet. *Batters* are semi-liquid mixtures which can be poured or dropped from a spoon. They are classified as "pour", "drop", and "thin pour" batters. For example, muffins require a pour batter, drop biscuits and cookies a drop batter, and waffles, griddle cakes, etc., a thin pour batter.

Quality of Bread. The texture, flavor, and attractiveness of the finished product depends upon (1) the quality and quantity of ingredients used; (2) the method of preparation (kneading, stirring, etc.); and (3) the time and temperature used in baking.

Ingredients and Their Uses. *Flour.* Different kinds of bread are made with different types of flour, depending upon the leavening agents used. Bread flour, used for yeast breads and rolls, is made from hard wheat which contains a large amount of gluten, while pastry flour, used for muffins, biscuits, waffles, griddle cakes, cookies, and cakes, is made from soft wheat which contains a much smaller proportion of gluten. Starch constitutes the largest part of all flour (except gluten flour) and gives to the bread its chief fuel value. Gluten, which is the protein of wheat, not only holds the ingredients together but with starch absorbs water and expands in the presence of heat, giving to the bread its elastic porous quality.

The development of gluten depends upon the extent of mixing and the amount and type of liquid used. Long mixing tends to toughen gluten and makes the leavening process more difficult. Gluten develops more quickly in a batter than in a dough.

Sugar is used to provide flavor and crispness, to assist in the browning process, and to make the finished product more tender since the development of gluten is lessened in the presence of sugar.

Eggs function as a leavening agent and as a binder to hold the ingredients together. The yolk of egg increases the fineness of the texture and the tenderness of the finished product. Whenever egg whites are used the following precautions should be observed: (1) the whites and yolks must be completely separated; (2) the whites should be whipped stiff but not dry. Only the number of eggs called for in the recipe should be used since too many eggs increase the protein content to such an extent that the finished product will be dry and tough when baked.

Fat increases the tenderness of the finished product by surrounding the starch particles, enhances the flavor, and increases the fuel value. Absorption of fat by food should be avoided since softening results, gas escapes, and the product falls and becomes soggy.

Milk increases the nutritive value of the product, and improves both flavor and texture. Water acts as a substitute for milk but the texture of the finished product is less fine.

Leavening agents include compressed and dry yeast, quick- and slow-acting baking powder, baking soda, cream of tartar, and eggs. The function of leavening agents is to raise the product and give it lightness and porosity, and to assist in the development of gluten to make the bread more elastic and porous. The leavening depends upon the yield of CO_2 when the product is moistened and heated.

Principles of Preparation. The texture and tenderness of bread as well as its lightness depends on the development of the elastic qualities of the gluten. Gluten is capable of holding large quantities of carbon dioxide which is formed during the growth of yeast. Doughs must first be kneaded or beaten. Yeast breads made into loaves require baking at a moderate temperature for 45 to 60 minutes, depending upon the size and shape of the loaf.

Quick breads — muffins, biscuits, griddle cakes, and waffles — are readily toughened if over development of the gluten occurs.

Therefore it is necessary to avoid excessive stirring of the batter or handling of the dough. For example, muffins require just enough stirring to blend the ingredients while longer mixing or beating causes tunnels to develop and spoils the texture of the finished product. Quick breads require a moderate to hot oven, biscuits requiring a somewhat hotter oven. The baking time for biscuits is from 10 to 15 minutes, for muffins from 20 to 30 minutes.

PROJECTS

1. Calculate the food values for the muffin recipe.

2. Compare the nutritive value of a slice (30 grams) of wholewheat bread, white bread, and enriched bread.

REVIEW QUESTIONS

1. What is the difference between a bread made with dough and one made with batter?

2. Enumerate the different leavening agents and give examples when each is used.

3. State the difference in breads made with milk and those made with water.

4. Why is bread called the "Staff of Life"?

5. What type of flour is used in making breads leavened with yeast? Why?

6. What is the objection to prolonged stirring in the preparation of breads leavened with baking powder?

7. What grain is used most extensively for bread making in the United States?

CHAPTER XLIII

Soups and White Sauces

SOUPS

Place in the Diet. Soups have occupied a place on the menu for centuries. For many generations soup has been served at the beginning of all formal dinners, and at other times as well. In the beginning the type of soup was a broth or clear soup. Such soups are rich in extractives, full flavored, and stimulating to the appetite. They are low in caloric value but contain some mineral salts especially sodium chloride. Vegetable soup, with a basis of meat stock and a number of vegetables as well as rice or macaroni, is rich in minerals. Such soups may contain some vitamins and bulk satisfying to the appetite. Cream soups, chowders, and gumbos are of excellent nutritive value. Cream soups and chowders are a good way in which to add milk to the diet, thereby supplying calcium and other minerals as well as some vitamins.

Classification of Soups. There are many types of soups such as:

A. Clear soups
   1. Bouillon
   2. Consommé
   3. Meat broths
   4. Clam and oyster broths
   5. Jellied bouillon
   6. Soup julienne — a clear soup with vegetables cut in thin strips.

B. Vegetable soups made with or without meat stock
   1. Home made soups of many kinds
   2. Canned vegetable soups

C. Cream soups made with white sauce and a pureé
   1. Cream of pea, lima bean, corn, bean
   2. Cream of asparagus, spinach, carrot
   3. Cream of tomato
   4. Clam or oyster bisque

D. Chowders made with milk plus fish, shellfish, and vegetables as potato, onion
   1. Fish
   2. Corn

E. Gumbo, a mixture of chicken, oysters, crab, shrimp, tomatoes, okra, and seasoning

Detailed instructions for the preparation of soups are found in the section on recipes.

WHITE SAUCES

White or cream sauces are valuable in that they are a means of using milk in the daily diet, they increase the caloric value of a food, and they introduce variety in the menu.

Ingredients. Milk, fat, and a thickening agent are the basic ingredients for white sauces. Cream, vegetable juices, or meat broths are sometimes substituted wholly or in part for the milk. The fat may consist of butter or margarine, vegetable oils, or meat drippings. Flour, cornstarch, tapioca, or egg yolk may be used as thickening agents if the following relationships are observed:

2 tablespoons browned flour equal 1 tablespoon raw flour
$\frac{2}{3}$ tablespoon cornstarch equals 1 tablespoon raw flour
1 teaspoon tapioca equals 1 tablespoon raw flour
1 egg yolk equals 1 tablespoon raw flour

Types. There are four commonly used consistencies of white sauce, each of which has its uses as indicated in the following table:

WHITE SAUCES

Consistency	Liquid Cups	Fat Table-spoons	Flour Table-spoons	Salt Tea-spoons	Uses
Very thin	1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	Cream soups made with starchy vegetables as peas, lima beans, corn
Thin	1	1	1	$\frac{1}{2}$	
Medium	1	2	2	$\frac{1}{2}$	Cream soup, creamed vegetables, creamed meats or fish
Thick	1	3	3	$\frac{1}{2}$	Croquettes, soufflés

Sauces may be varied by using finely chopped or puréed vegetables, commercial colorings, or by browning the flour. The addi-

tion of sugar, and chocolate, caramel, or other flavorings to thick white sauce is necessary for puddings.

Method of Cookery. The thickening agent is blended with the fat to separate the starch granules. Liquid is added gradually to the starch paste, stirring to obtain a smooth mixture. The sauce is cooked in a double boiler to prevent scorching the milk and to allow the starch to cook thoroughly. The starch cells absorb liquid, and when heated thickening consequently occurs. It is important to stir white sauces frequently during the cooking to prevent the formation of lumps.

PROJECT

Calculate the carbohydrate, protein, fat, and caloric values for each of the four basic recipes for white sauce.

REVIEW QUESTIONS

1. What is the value of soup in the diet?
2. Which type of soup furnishes the greatest amount of nourishment? What nutrients are present in appreciable amounts?
3. Name four types of soup and give an example of each.
4. Give the progressive steps in the preparation of cream sauces. Give the reasons for each step.
5. Name eight ways in which cream sauces may be used in menu planning.

CHAPTER XLIV

Vegetables

Classification. Vegetables include a large number of plant foods which may be classified in several ways. The part of the plant used and its type is the basis for the following classification. It will be noted that practically every part of the plant is represented in these groups.

1. Flowers: broccoli, cauliflower, French artichokes
2. Green leaves: Brussels sprouts, cabbage, chard, dandelion greens, endive, lettuce, mustard greens, parsley, spinach, turnip greens, watercress
3. Fruits: cucumbers, eggplant, green peppers, okra, pumpkin, squash, tomatoes
4. Stems: asparagus, celery
5. Roots: beets, carrots, kohlrabi, parsnips, rutabagas, salsify, sweet potatoes, turnips
6. Tubers: Jerusalem artichokes, Irish potatoes, tara
7. Bulbs: mature onions, shallots
8. Seeds: beans, lentils, peas, soy beans, and green corn

Vegetables which are yellow or green in color are usually distinguished from those which are not, since the former are such excellent sources of some of the important vitamins.

Composition. All vegetables except those which are artificially dehydrated have a high water content. Even potatoes which are considered to be high in starch contain much more water than solids.

Carbohydrates. The kinds of carbohydrates found in vegetables are starch, dextrin, sugars, and cellulose. The leafy and stem vegetables contain the least carbohydrate, while the tubers, roots, and seeds are the richest in carbohydrate. For convenience the Home Economics Bureau of the Department of Agriculture has classified vegetables according to their carbohydrate content as 3, 6, 9, 12, 15, and 18 per cent (see classification on page 721).

The structural parts of vegetables, or cellulose, are valuable for the bulk they give to the diet. This bulk is so essential for the maintenance of normal peristalsis in the gastro-intestinal tract.

Protein. The vegetables with the exception of the legumes and peanuts are not rich in protein, nor is the protein of superior quality. The legumes, especially soy beans and peanuts, are rich in protein and make good supplementary food for increasing the protein content of the diet. In vegetables other than beans, peas, lentils, and peanuts, the protein content ranges from 1 to 2 per cent.

Minerals. Vegetables are top ranking as sources of minerals and vitamins. Turnip greens rank first among the vegetables as a source of calcium; even after cooking three ounces (about one half cup) of turnip greens will supply approximately one third of the day's allowance for the adult. Mustard greens, collards, kale, and broccoli are likewise good sources of calcium. The calcium in kale and collards is not so well utilized as that of turnip greens, while the calcium of spinach, tender greens, beet greens, chard, and lambsquarters is not nutritionally available because of the high oxalic acid content in the latter group.

The leafy vegetables are fair to good sources of iron. A three ounce serving of turnip greens, spinach, mustard greens, or chard will supply approximately 25 per cent of the adult's daily allowance for iron, while kale and head cabbage supply somewhat less. Much work still remains to be done on the utilization of iron in foods. As yet there is no truly satisfactory method for the determination of availability of iron in foods to man. Although the amount of iron in many vegetables appears to be relatively high, there is experimental work to indicate that the proportion which is available to the body is low. Some authorities estimate availability of iron as being 10 to 15 per cent, while others rate it over 50 per cent.

Copper, potassium, phosphorus, and other minerals are also supplied by vegetables.

Vitamins. Vegetables, like fruits, rank high as sources of vitamins, raw vegetables being especially good. The green leafy and yellow vegetables together with tomatoes are among the richest sources of carotene. The carotene of the green vegetables seems to be better utilized than that of yellow vegetables. The allowance for

carotene in the diet must be greater than that which is necessary if vitamin A itself is given.

The succulent vegetables are not rich in thiamine, but as a rule the amount consumed is sufficiently large to make them important contributors to the thiamine content of the diet. Riboflavin is contained in a number of vegetables, the leaves showing the highest percentage. About one fourth of the day's allowance for an adult is supplied by a serving of cooked beet greens, and one fifth of the day's allowance by a serving of spinach or kale.[1] Other vegetables furnish lesser amounts. Niacin occurs in liberal amounts in tomatoes, green peas, kale, mustard greens, turnip greens, and collards. These foods are mentioned by Sebrell[2] as being with milk, liver, lean meats, fish, and eggs the most important foods to add to the diet in, or for protection from, pellagra.

Acid-Base Balance. The mineral elements present in vegetables contribute to an alkaline end reaction in the body and consequently vegetables aid in the functioning of the acid-base balance system of the body.

Daily Use in the Diet. The diet should include two or more servings of vegetables daily, one of which should be green or yellow. Raw vegetables should be used frequently to supplement fruit for supplying the necessary ascorbic acid.

Selection and Care of Vegetables. Crisp vegetables which are firm in texture and free from blemishes and decay should be selected. Since many of them deteriorate rapidly it is essential that proper storage facilities be considered. Potatoes, carrots, beets, onions, and turnips may be stored in a cool dry room where there is circulation of air. Most other vegetables should be washed and placed in the hydrator of the refrigerator or wrapped in wax paper until they are to be used. Vegetables should be used as soon as possible after their purchase if maximum vitamin values are to be retained.

Vegetables may also be purchased as frozen, dried, or canned products. The cost of frozen vegetables at present is generally somewhat higher than that of products in season, but the nutritive values are high, the flavor is excellent, and little labor is involved in preparation. The legumes are the most commonly used of the dried vegetables. Overnight soaking is not necessary for the pre-cooked beans

and peas. Canned vegetables approximate the fresh products from the standpoint of nutritional value, since commercial canneries are able to exclude air from the can. It is well known that the presence of oxygen can be destructive of ascorbic acid especially.

Principles of Cookery. The cooking of vegetables softens the cellulose and breaks the starch cells so that the carbohydrates are more accessible to the starch splitting enzymes. The flavor and palatability of many vegetables is improved by cooking. The following practices result in increased loss of vitamins and minerals and should therefore be avoided.

1. Long soaking of the vegetables in water deprives them of much of the water-soluble vitamins. For example, if dried beans are soaked over night and the water in which they were soaked is discarded, much of the thiamine originally contained in the beans will be lost. Likewise, fresh vegetables allowed to stand in water for a long time will lose ascorbic acid as well as the water-soluble B vitamins.

2. Chopping and grinding tends to destroy some of the vitamins because of increased exposure to the air.

3. Stirring of vegetables during the cooking process increases the loss of ascorbic acid because of the rapid oxidation which takes place.

4. Paring of vegetables removes much of the vitamins and minerals which occur in greatest concentration next to the skin.

5. Alkalies such as baking soda are sometimes added to vegetables to preserve their color, but this practice is highly destructive of ascorbic acid and thiamine.

6. Wilted vegetables are lower in carotene content than fresh, crisp vegetables. Proper selection at the market together with careful storage will eliminate this loss.

Methods Used in Cooking Vegetables. There are various ways of preparing vegetables, boiling, steaming, and baking being among those most universally used:

1. Baking, with or without removing the skin. This method has the advantage of retaining the minerals which lie close under the skin if they are not pared. Potatoes, eggplant, and squash are best suited for baking.

2. Steaming. This retains almost all of the minerals. Spinach,

chard, broccoli, and asparagus are especially adapted to this method of preparation.

3. Cooking with little or no water. A heavy cast aluminum or other heavy metal vessel with a close-fitting top preserves the flavors, reduces mineral loss, allows little oxidation, and conserves the vitamins. String beans, turnip and mustard greens, carrots, green peas, etc. may be prepared in this way.

4. Boiling. Such strongly flavored vegetables as cabbage, Brussels sprouts, and cauliflower are more delicate in flavor if cooked in a quantity of boiling water for a short period of time.

5. Sautéing. Eggplant, green or ripe tomatoes, and cucumbers are cooked to advantage by this method. Thin slices of the vegetable are rolled in crumbs and browned in a small amount of fat.

The detailed methods for the preparation of various vegetables are given in the section on Recipes, page 654.

PROJECT

Calculate a day's menu in which at least one fourth of the allowance for vitamin A, one fifth of the necessary riboflavin, and one third of the essential vitamin C is obtained from vegetables.

REVIEW QUESTIONS

1. Name the parts of the plant which are used as vegetables. Give examples of vegetables belonging to each group.
2. Outline briefly the general composition of vegetables.
3. Why are vegetables included among the essential basic food groups?
4. Name the most important vegetable sources of calcium and iron.
5. Which vegetables yield the greatest number of calories?
6. Name three vegetables which are good sources of ascorbic acid; of riboflavin; of vitamin A.
7. Describe briefly the preparation and cookery of spinach, white potato (one method), and vegetable cream soup.

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CHAPTER XLV

Fruits

Fruits belong to a large group of seed bearing plants. They are much alike in composition but vary widely in their individual characteristics, flavor, color, odor, and palatability. As a group fruits are not high in fuel or protein value but they are important for the minerals and vitamins which they contain. The National Research Council places fruit with other basic food groups, recommending the daily inclusion of one citrus and one other fruit.

Classification. Fruits may be classified as:

1. Orchard fruits: apples, apricots, bananas, cherries, dates, figs, nectarines, peaches, pears, plums, quinces, persimmons; citrus fruits as grapefruit, kumquats, lemons, limes, oranges, and tangerines

2. Vine fruits: grapes

3. Small fruits: all berries as blackberries, cranberries, currants, gooseberries, raspberries, strawberries

4. Garden fruits: melons as cantaloupe, casaba, honey dew, muskmelon, Persian, watermelon; cucumber, eggplant, pumpkin, squash, and tomato are generally grouped with the vegetables although botanically speaking they are fruits.

Fruits are also classified according to their carbohydrate content as 6, 9, 12, 15, and 18 per cent or more carbohydrate (see Classification of Fruits and Vegetables, page 721).

Composition. Water is the chief constituent of fruit, comprising about 80 per cent of the total weight.

Protein and Fat. Fruits contain very little protein and are practically fat free. Avocados and olives, however, contain appreciable amounts of fat.

Carbohydrates. The carbohydrate content of fruit varies widely, from 7 per cent in strawberries and cantaloupe to 32 per cent in native persimmons (see Classification of Fruits and Vegetables, page 721). The carbohydrate in fruits is in the form of cellulose, starch,

pectin, and sugars, particularly sucrose, fructose, and glucose. The skins, seeds, and fibers are made up of cellulose which is an unavailable carbohydrate. Pectin is responsible for the ability of fruits to gel when cooked with sugar. The kind of sugar present in fruit is determined by the degree of ripeness; that is, green fruits have more starch and less invert sugar than ripe fruits.

Minerals. Fruits are valued highly for their minerals such as:

1. Iron which occurs especially in fresh or dried apricots, peaches, prunes, raisins, bananas, apples, and citrus fruits,

2. Calcium which occurs in small amounts in citrus fruits, dried figs, etc., and

3. Sodium, chlorine, and potassium which are present in varying amounts in practically all fruits.

Vitamins. The chief vitamins contained in fruits are vitamin C, vitamins of the B complex, and vitamin A.

Vitamin C. Citrus fruits are outstanding in their vitamin C content. They are so reliable a source that the daily inclusion of orange juice in the diet has become practically a routine measure in children's hospitals throughout the world. So rich in ascorbic acid are oranges that one medium-sized orange (5½ ounces) will supply the amount required daily by an adult. About 6 ounces of canned grapefruit juice or 4½ ounces of canned orange or lemon juice will be sufficient to cover the needs of an adult. Fresh strawberries and cantaloupe are also rich in ascorbic acid. An adult's daily needs would be covered if 100 grams (approximately ⅓ cup) of strawberries were eaten, this amount supplying from 40 to 104 mg. of ascorbic acid.[1] Pineapple (usually canned) will supply about half as much vitamin C as citrus fruits. Peaches and apricots, freshly picked, contain appreciable amounts of the vitamin but not so much as the citrus fruits or strawberries.

Vitamin A. Of the fresh fruits apricots and yellow peaches rank first as important sources of vitamin A. About 3½ ounces of fresh or canned apricots will supply the amount required daily for adults, while about three times that amount of canned or fresh peaches would be needed. Weight for weight, apricots and peaches which are dried supply about three times the amount found in fresh fruit. Cantaloupe has about one half as much vitamin A as peaches. Bananas are a significant source of vitamin A.

THIAMINE. Plums rank first among the fresh fruits as a source of thiamine. Citrus fruits and pineapple contain small amounts of thiamine and contribute to the daily diet.

Organic Acids. Characteristic flavors of fruits are due in part to:

1. Citric acid found in citrus fruits, — oranges, lemons, grapefruit, and tangerines — as well as in strawberries and raspberries
2. Malic acid in apples, peaches, apricots, plums, prunes, and cherries
3. Tartaric acid found in grapes, cherries, and berries

Place of Fruit in the Diet. Fruits and vegetables rank first among the foods which function as body regulators. Most fruits (except plums, prunes, and cranberries) have an alkaline reaction and serve to neutralize the toxic acids formed in the body. The alkaline salts furnished by fruit assist in maintaining the body's acid-base balance, and in building up the normal alkaline reserve. It should be particularly noted that the acid- or sour-tasting fruits also give an alkaline reaction in the body. The acid taste is due to the presence of organic acids which, however, are oxidized in the body.

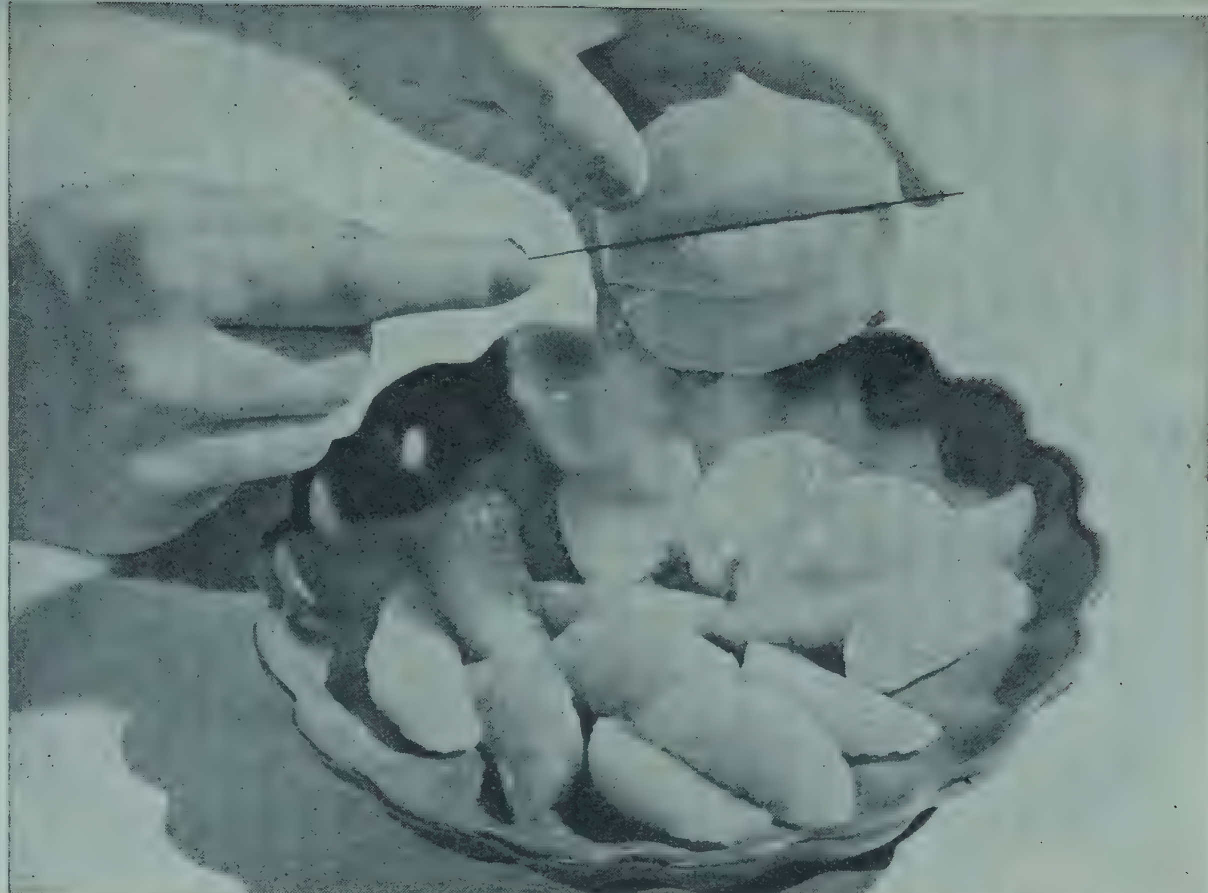
The cellulose of fruit, although indigestible, is important to health since it gives the necessary bulk to the food mass and stimulates passage of the latter down the intestinal tract, thus promoting good elimination and helping to prevent atonic constipation.

The high water content of fruit is important in the maintenance of the body's water balance as well as in the regulation of elimination.

The iron supplied by fruit is particularly well utilized by the body. Von Voorden says: "If we limit the most important sources of iron, — the fruits and the vegetables, we cause a certain sluggishness of blood formation and . . . lack of reserve iron, such as is normally found in the liver, spleen, and bone marrow of healthy, well-nourished individual[2]."

The vitamin value of fruits cannot be overestimated. Not only are vitamin C, vitamin A, and thiamine essential to growth, the health and functioning of the gastro-intestinal tract and the nervous system, but each of these vitamins plays an essential part in the prevention and cure of certain deficiency diseases.

Uses of Fruit. Fruits may be included in the dietary in many forms. Fruit juices serve not only to quench thirst but also to bring



Courtesy of California Fruit Growers Exchange, Los Angeles, California

Fig. 40. Sectioning an Orange

additional nourishment into the body in one of the most acceptable ways. Fruits may be used as breakfast fruits, either raw, cooked, or as juices; as fruit cups at the beginning of luncheon or dinner; as salads, which lend color and flavor to any meal. Fruits for desserts, always high in flavor, are used cooked or uncooked, in pies, cakes, whips, gelatins, water ices, and ice creams.

Care should be exercised in the selection of fruit since fermentation may have begun in overripe fruit, while on the other hand the flavors and sugars are not fully developed in underripe products.

Fruits should be fully ripe at the time of eating. They should be washed thoroughly and stored in the refrigerator until they are to be used. Berries are washed just before serving to avoid mold growth. Bananas become blackened if subjected to icebox temperatures and should not be chilled.

Fruits may be preserved by cold storage, canning, drying, or freezing. The use of sugar in canning increases materially the caloric value of the resultant product. Commercially canned fruits retain somewhat more vitamin C than home canned or cooked fruits. Cooking, in most cases, diminishes the flavor of fruits, softens the cellulose, and makes the fruit more digestible.

PROJECTS

1. Calculate an adequate diet containing 75 or more milligrams of ascorbic acid.

2. Calculate the amount (in grams) of each of the following fruits necessary to replace the carbohydrate of 100 grams of orange: cantaloupe, blueberries, grapefruit, strawberries, grapes, banana, peaches, apricots, dried prunes.

REVIEW QUESTIONS

1. Give the approximate composition of fruit.
2. Outline the functions of fruit in the body.
3. Name the fruits belonging to the citrus group.
4. For what nutrients are the citrus fruits most valuable?
5. Name the best fruit source of the following factors: iron, calcium, vitamin C, vitamin A.
6. How much orange juice would an adult have to take a day to supply his normal needs of ascorbic acid?

7. List five ways in which fruits may be combined with other foods for variety.

8. What points should be especially noted in the selection of fresh fruits?

9. How do commercially- and home-canned fruits compare in their vitamin content?

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CHAPTER XLVI

Salads and Salad Dressings

Value of Salads in the Diet. The inclusion of a salad as an integral part of a luncheon or dinner has become more and more common in the last few years. Because of their rich mineral and vitamin value, salads have ceased being considered a luxury and have become a recognized part of the meal. They are, moreover, one of the best ways of increasing the cellulose content of the diet. A salad is a good source of protein when such materials as cheese, fish, eggs, or meat constitute the chief ingredients. When served with an oil dressing it adds materially to the caloric value of the meal. Salads serve to balance the meal, and by their color enhance the attractiveness of food service.

Types of Salads. There are six types of salad, each of which has its use in building menus.

1. Green salads are made of crisp raw salad greens such as lettuce, romaine, chicory, escarole, endive, shredded cabbage, or watercress. They are appropriately used as the appetizer or first course at luncheon or dinner, or they may be served with the main course of a meal. A French dressing is usually served with such a salad.

2. Vegetable salads consist of raw or cooked vegetables as potatoes, carrots, cucumbers, tomatoes, beets, asparagus, or green peppers used singly or in combinations of two or three. Small light vegetable salads are usually served with the main course of the meal or occasionally as a separate course, while a more substantial salad may be used together with meat or cheese for the main course; for example, potato salad with cold cuts of meat.

3. Fruit salads may consist of a single fruit or combinations of two or three of the following: oranges, grapefruit, pineapple, apple, pear, peach, or prune. They are used in place of a dessert or frequently when a light refreshment is desired. Some of them may be

used with the main course of a meal. They may be served with variations of French dressing, mayonnaise, or a fruit salad dressing.

4. Jellied salads are combinations of fruit or vegetable gelatins and pieces of fruit or vegetables, respectively. Depending upon the type, they are served with the main course of the meal, or as a separate salad course.

5. Frozen salads are combinations of fruit or vegetables with mayonnaise or cream which are frozen. Such salads are popular desserts.

6. Protein salads contain cooked meat, chicken, fish, eggs, soy beans, or cheese as the main ingredient. Salad greens and various vegetable combinations are used with the protein foods. These salads are used primarily as the main course of the meal where they substitute for the meat and vegetable which would otherwise be served.

Essentials for a Good Salad. The success or failure of a salad is dependent on the observation of certain rules. A salad, first of all, should be pleasing to the eye in order to stimulate the appetite. Salad greens are appropriate and attractive bases for any kind of salad. Well chosen garnishes also lend eye appeal. Simple, rather than elaborate arrangements of food are to be desired, for too precise, exact arrangement suggests unnecessary handling of food. No salad is successful unless it is fresh, cold, crisp, and dry. This necessitates thorough chilling of the salad plate and the salad ingredients as well as careful draining of foods packed in juices. Appropriate combinations of food with a suitable salad dressing are essential. The salad should not be prepared long ahead of the time it is to be served. Certain fruits as bananas, apples, peaches, and pears discolor readily. If they are sprinkled with lemon juice immediately after being cut such discoloration can be avoided. Meat and vegetables should be cut in attractive small pieces, while most fruits may be cut in somewhat larger pieces.

The recipe section (pages 636-41) contains further details on salad preparation, and suggestions for food combinations.

SALAD DRESSINGS

Salad dressing is to a salad what butter is to hot vegetables. It is the final touch to give the salad flavor, color, and calories.

There are a number of dressings, but all fall under three main headings:

1. Mayonnaise, which is a mixture of egg, oil, acid, and seasoning, is so blended that a permanent or stable emulsion results.

2. French dressing is a combination of acid, oil, and seasoning blended to form a temporary emulsion.

3. Cooked dressing is a mixture thickened with egg or flour. It usually contains an appreciable amount of acid.

Oils Used in Salad Dressings. Olive oil is preferred to other oils for salad dressings because of its fine flavor. It may be imported or domestic and may be obtained in three grades. The best grade, Virgin oil, is made from ripe olives in which little if any pressure has been used to express the oil. This grade is very expensive and constitutes only a small part of the olive oil sold. The second grade of oil is also expressed from the flesh of ripe olives but the olives are crushed and the extraction is made under pressure. The greater part of the olive oil on the market is of this grade. The third grade of oil is made by heating the residue remaining from the first and second extraction and applying pressure to extract the oil.

Cottonseed oil is extensively used as a salad oil especially in the United States. The seed is delinted to remove the cotton fiber, the hulls are removed, and the flesh is ground, heated, and placed under pressure to express the oil. The crude oil is then refined to remove all extraneous material, leaving a clear, medium yellow oil.

Corn oil, made from the crushed dried germ of the corn, is extracted under heavy pressure.

Salad oils are pure fats and must be stored in a cool place to keep them free from rancidity. Oil solidifies if kept in a very cold part of the refrigerator. The oil container should be kept tightly covered.

PROJECTS

1. Give two illustrations for each type of salad. State what salad dressing you would use with each salad.

2. Calculate the protein, calories, calcium, iron, vitamin A, ascorbic acid, thiamine, and riboflavin value of a salad made with green pepper stuffed with cream cheese.

REVIEW QUESTIONS

1. Why are salads important parts of a menu?
2. Name the minerals and vitamins supplied by a citrus fruit salad.
3. Name the different types of salad. What is meant by salad greens?
4. Outline the standards for a good salad.
5. State the essentials for salad making.
6. Why is an acid used in the preparation of mayonnaise?
7. What makes French dressing a temporary rather than a stable emulsion?
8. List variations for each of the following salad dressings: mayonnaise, French dressing, cooked dressing.

CHAPTER XLVII

Desserts

The dessert is the high point of the meal for many people. It is characterized first of all by its sweetness. Foods which are sweet satiate quickly, and therefore it is logical that they should be placed at the end rather than at the beginning of a meal.

Essentials for a Good Dessert. A successful dessert is one that completes the meal but does not dominate it. It must fit in with the particular meal; that is, a heavy meal requires a light dessert, while a light meal may require supplementary protein, calories, etc. A dessert must appeal to the appetite by reason of its attractive service, color, or flavor. It must be sufficiently sweet but not over sweetened. It should be properly flavored and correct both in texture and temperature.

Classification of Desserts and Their Place in the Diet. There are many types of desserts and numerous choices within each class.

1. Fruits of all kinds are excellent for desserts. They may be served alone as fresh, stewed, canned, or baked fruit, with or without sugar; or they may be combined with foods as suggested below. Fruits are relatively low in caloric value but are fair to rich sources of minerals and vitamin C.

2. Gelatin desserts may be made with fruit juice and gelatin alone, or they may consist of (1) jellies with added whole fruit or (2) whipped jelly with whipped egg white or cream. Orange Bavarian cream and Spanish cream illustrate the latter type of gelatin dessert.

3. Milk and egg desserts are possible in almost endless variety as custards, junkets, and puddings. They are the most nutritious of all desserts since they make valuable contributions to the protein, mineral, and vitamin as well as caloric level of the diet. They are among the most readily digested foods.

4. Starchy desserts combine various cereals as rice, tapioca, corn-

starch, or bread with milk and, usually, eggs. Rice, tapioca, and bread puddings are examples of such desserts.

Cakes, cookies, and pastries are popular desserts which are high in carbohydrates and often high in fat. Fruit is frequently used in pastries, as for example in apple pie.

5. Frozen desserts include water ices, milk sherbets, and ice cream.

Gelatin and Its Uses. Gelatin is collagen which is extracted by boiling the connective tissue, cartilage, and bones of animals. It contains 86 per cent protein and 14 per cent water. The protein of gelatin lacks some of the essential amino acids, but it is of good supplementary value when used with milk and eggs. Gelatin may be used for the preparation of desserts, fruit, aspic, and vegetable salads, or jellied consommé.

When preparing gelatin dishes it is necessary to soak the dry granulated gelatin in cold water to soften and swell the granules. The hot liquid (water, fruit, or vegetable juice) is then poured over the gelatin, and the mixture is stirred until all the gelatin is dissolved. Sugar is added if a dessert is being prepared. The mixture is cooled before being placed in the refrigerator to congeal.

Cut fruit or vegetables are added to jellies after thickening has begun to avoid settling of the food in the bottom of the mold. Fresh pineapple cannot be used in gelatin desserts since this fruit contains an enzyme which splits the gelatin so that the product will not stiffen. Whipped cream or egg white is added to gelatin after it has begun to thicken.

Milk Desserts. Junket is a coagulated milk preparation which is made by adding rennet or junket powder to sweetened milk heated to a temperature not to exceed 100° F. Excess heat destroys the rennin, and milk will not coagulate. Junket must be mixed quickly and allowed to set before being placed in a refrigerator.

Milk and egg desserts are cooked in a double boiler since milk scorches readily and egg proteins become toughened if the temperature is too high. The water in the bottom part of the double boiler should be kept below the boiling point for the preparation of soft custards.

Whenever cornstarch or flour is used for a thickening agent it is necessary first to make a thin paste with cold milk. The paste is

then added to the hot milk and the pudding is stirred until thickened to prevent the formation of lumps.

PROJECTS

1. Calculate the protein, carbohydrate, and calories in one serving of orange jelly using the recipe on page 608.

2. Calculate the protein, carbohydrate, calories, and calcium in one serving of junket, using the recipe on page 604.

REVIEW QUESTIONS

1. What is gelatin? To what food group does it belong?

2. Name three ways of incorporating gelatin in the diet.

3. Gelatin should not be used as a sole source of protein in the diet. Why?

4. What are the steps in the preparation of a fruit juice gelatin? Give the reasons for each step.

5. A baked custard is an excellent dessert. Why? What precautions are necessary for the preparation of custards?

6. What is junket? How is it prepared?

CHAPTER XLVIII

Cheese

Cheese is a milk product representing the solids or curd of milk. There are two general types of cheese: (1) hard cheese such as American cheddar, Swiss, brick, Edam, Parmesan, and Roquefort; and (2) soft cheese such as cottage, cream or Neufchâtel, Camembert, Brie, Limburger, and Gorgonzola. Cheeses owe their characteristic flavors to the kind of milk used, the method used for curding the milk, the type of molds or bacteria allowed to grow in them, the amount of salt or other seasonings added, and the conditions of ripening (temperature and humidity).

Nutritive Value. The composition of cheese depends upon the kind of milk used — whole or skimmed, and the amount of water present. A pound of hard cheese contains the casein and fat of one gallon of milk. During the process of ripening, the protein becomes more or less digested to soluble protein; that is, to proteoses, peptones, and even amino acids. The average composition of hard cheese is: protein 25 per cent; fat 35 per cent; calcium 0.97 per cent; and phosphorus 0.68 per cent. It ranks high as a source of vitamin A and riboflavin.

Soft cheeses, as cottage cheese, vary considerably in their composition. If made with skim milk, cottage cheese will contain as little as 1 per cent of fat; the protein content is about 19 per cent. Cottage cheese is relatively lower than cheddar cheese in its calcium content since some of the calcium is lost in the whey with acid coagulation.

The digestibility of cheese has often been questioned. However, this idea may be due to the fact that cheese is often eaten following a meal sufficiently rich in protein. When eaten at the appropriate time and well masticated it should not be hard to digest.

Place in the Diet. Cheese is a superior protein food which can be substituted for meat. Its chief protein is casein which contains all

the essential amino acids. The important contributions of fat, calcium, phosphorus, and vitamin A should give this food a more prominent place in the American diet than it now holds. It should serve as a supplementary food in a meal otherwise low in protein or where protein is of poor quality; it is an economical substitute for meat, poultry, and fish.

Ways of Using Cheese. There are so many varieties of cheese, and their use is so varied that it is possible only to suggest some of the ways to include this valuable food in the menu.

1. Main dish at luncheon or supper as a substitute for meat, fish, etc., in the form of omelet, soufflé, fondue, or Welsh rabbit
2. As a hearty salad, such as peppers or tomatoes stuffed with cheese, or cream cheese and nut salad, etc.
3. As cheese sauce for vegetables such as broccoli, cauliflower, potatoes, etc.
4. In combination with spaghetti, macaroni, etc.
5. As filling for sandwiches
6. As a garnish for soup (grated hard cheese such as Parmesan or Roman)
7. As a substitute for dessert at the end of dinner, using highly ripened cheese such as Roquefort, Camembert, Brie, etc., and hard crackers. This practice of serving cheese at the end of a long, elaborate meal has been in use for hundreds of years and may be one reason why cheese has gained the reputation of being hard to digest. If used instead of dessert following an ordinary, well-balanced meal where the protein supply is not great, and especially if well masticated, cheese should not cause discomfort.

Principles of Cookery. Whenever cheese is used as an ingredient of cooked dishes its protein nature should be remembered. Cheddar cheese softens at about 120° F., melts at 160° F., and toughens at 185° F. Low cooking temperatures should therefore be employed whenever cheese is to be melted.

PROJECTS

1. Calculate the food value of the recipe for cheese soufflé.
2. Compare in table form the carbohydrate, protein, fat, caloric, calcium, and vitamin A values of 100 grams of cheddar, cottage, cream, and Swiss cheese.

3. About how much American cheese must be used in the diet to replace the protein and calcium of one glass (200 gm.) of milk? Show method of calculation.

REVIEW QUESTIONS

1. What are the two types of cheese? Give examples of each.
2. List the factors which determine the flavor of cheese.
3. Why is cheese an important food?
4. Why should cheese preferably be used in combination with other foods?
5. Give various ways in which cheese may be used in the diet. Illustrate.
6. Why is cottage cheese more readily digested than some other forms of cheese?

CHAPTER XLIX

Meat, Poultry, and Fish

Meat is the name given to the flesh of some animals as beef, veal, mutton, lamb, and pork. As an inclusive term it may also be applied to poultry and fish.

Place of Meat in the Diet. Meat of various kinds is universally used. There is not a country in the world in which some kind of meat is not eaten more or less extensively. In America approximately one fourth of the expenditure for food is commanded by this group of foods. Meat is the most expensive item in the daily menu, and hence we find that the lower the income the less meat will be used and the poorer the quality of the meat will be.

Meat is highly satisfying to the appetite, and this feeling of satisfaction lasts longer than for other types of food. Beef has been the most popular meat in this country, but pork has grown in popularity so that it now equals or outranks the production of beef.

Composition of Flesh Foods. The chief constituents of meat are protein, fat, water, and mineral salts.

Protein. Muscle tissue of animals considered separately from the deposited fat contains 20 to 25 per cent protein. The lean meats contain more protein than meats with much fat. Meat contains the ten essential amino acids in appreciable amounts so that the proteins are of excellent quality.

Fat. The fat content of meat depends upon (1) the degree of leanness of the meat, (2) the type of animal, and (3) the age of the animal. Beef contains less fat than pork, and young animals have fewer fat deposits than older animals. Some cuts of meat are higher in fat content than others. The adipose tissue of animals contains 80 to 90 per cent fat, and 10 to 15 per cent water, being similar in composition to butter.

Minerals. The mineral content of meat is proportional to the protein content. Meats are poor sources of calcium but rich in phos-

phorus and sulfur. They are a fair to good source of iron. The liver, heart, brain, and kidney are much richer in iron than muscle tissue.

Vitamins. Meats in general contain little if any vitamin A and ascorbic acid. Liver, however, is one of the richest known food sources of vitamin A. The glandular organs and muscle tissue are both excellent sources of riboflavin. Pork is outstanding for its thiamine content, while glandular meats also rank high in their content of this vitamin. Muscle tissue contains thiamine in about the same concentration as it is found in eggs. Lean meats contain niacin although the relative concentration is small.

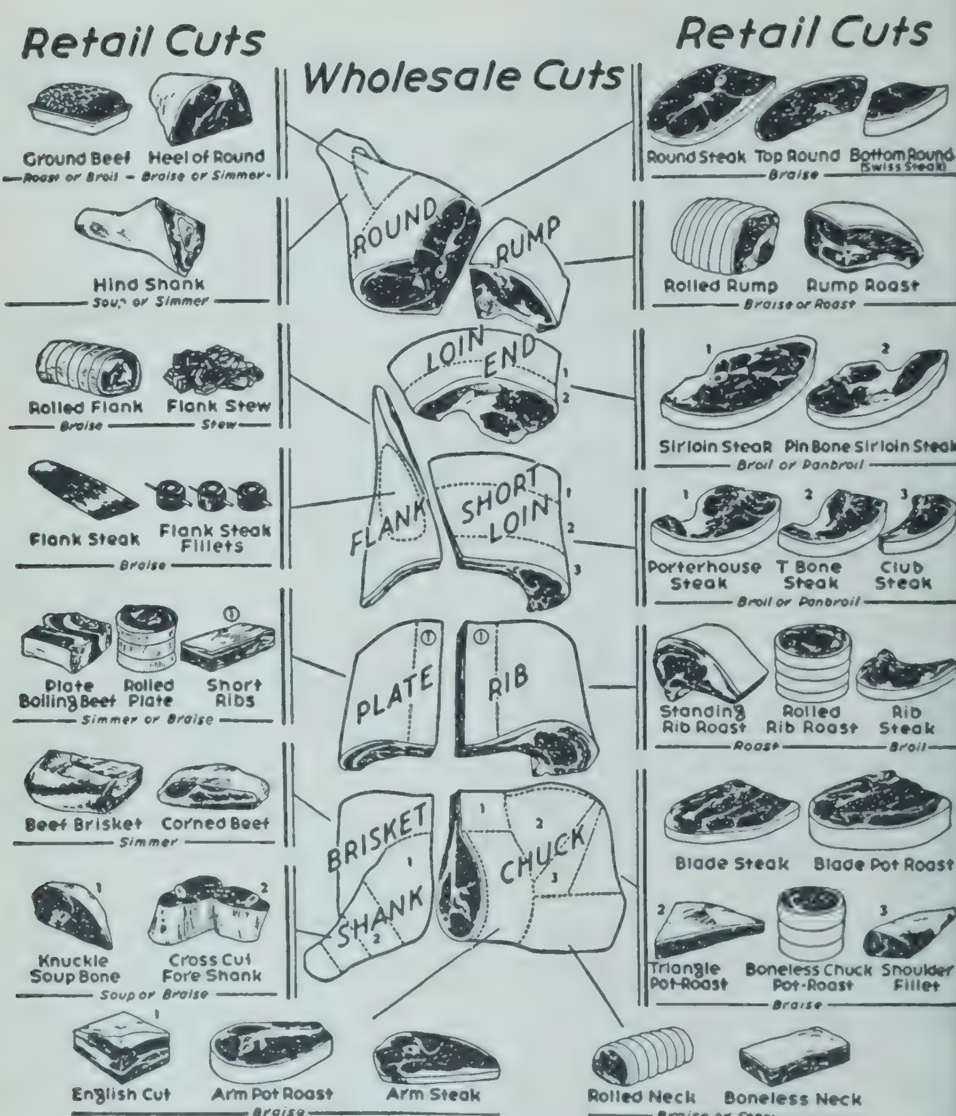
Extractives and Purines. The extractives give to the meat its characteristic flavor. A large percentage of these substances are purines which have very little fuel value. Meat broths represent an extraction of these non-protein nitrogen products.

Digestibility. The digestibility of meat is dependent upon the fat content and the method of cooking. The less fat and connective tissue the meat contains the more complete is its disintegration and the more rapid its passage from the stomach. The digested products of meat are very completely absorbed leaving little if any residue in the intestinal tract. The soft yellow fat of meat is more readily digested than the hard white fat.

Selection of Meat. Many factors should be considered in the choice of meat.

Safety as a Food. Inspection of meat by the government is strictly enforced whenever interstate sale is concerned. The government seal of inspection, a small purple mark stamped on meat, indicates that the meat has been inspected for freedom from disease, and that it has been made ready for the market under sanitary conditions. As a rule the period of hanging, the temperature of the cold room, and the internal temperature of the meat itself are all factors affecting the safety as well as the tenderness of meat. Soiled hands on the part of the butcher, dirty meat blocks and meat grinders, as well as dust and dirt coming in contact with openly exposed meat are among the factors militating against the safety of meat, since the bacterial count of such meat is likely to be too high for safety. The retail market should be selected with care since the most carefully inspected meats may not be safe if carelessly handled by the retailer.

BEEF CHART

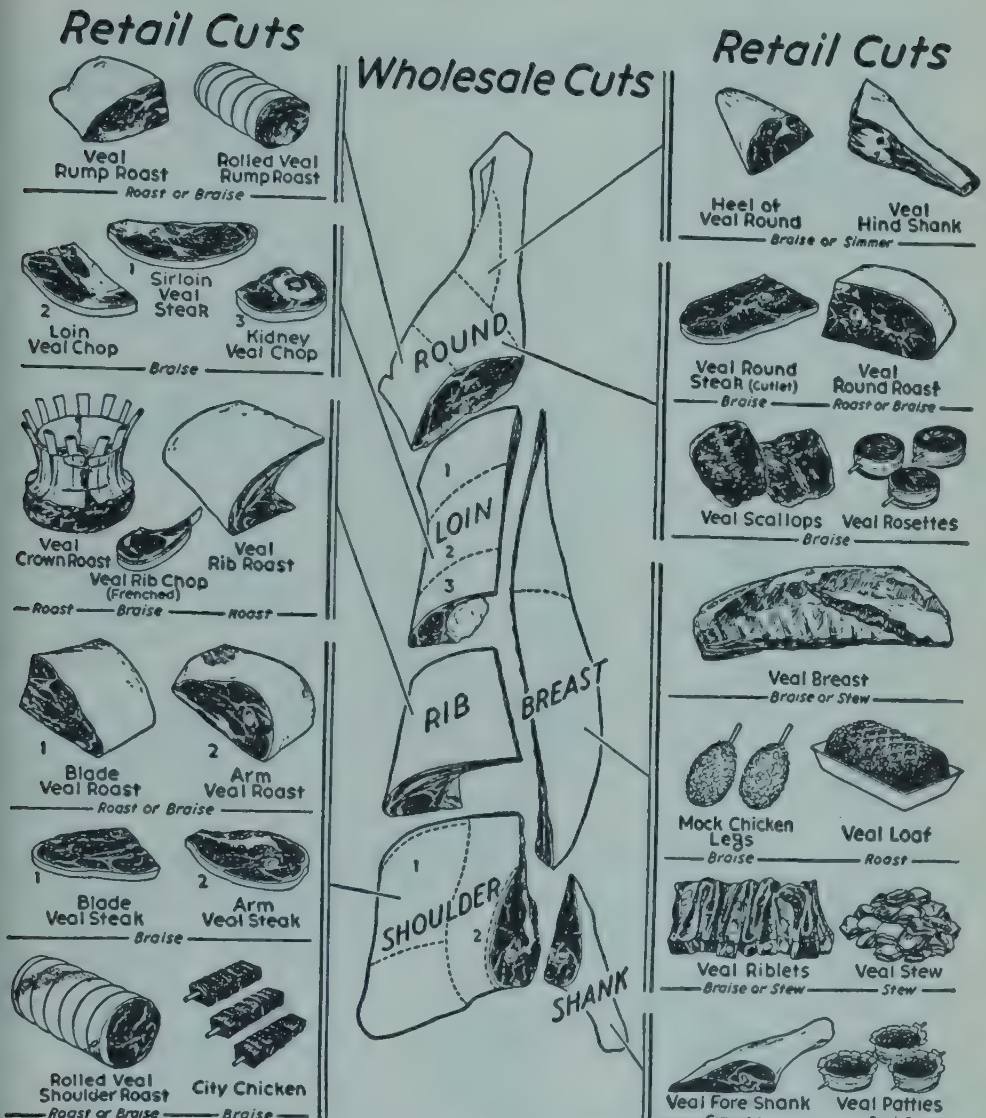


Courtesy National Live Stock and Meat Board

FIG. 41.

Tenderness and Texture. The tenderness of meat is dependent on the (1) muscular development, (2) part of the animal or cut of meat, (3) age, and (4) amount and kind of connective tissue. Meat cut from resting muscles is more tender than the cuts taken from muscles constantly energized (the flank, for example). The latter are rich in extractives and if properly prepared are both palatable and economical. The meat from cattle and poultry allowed

VEAL CHART



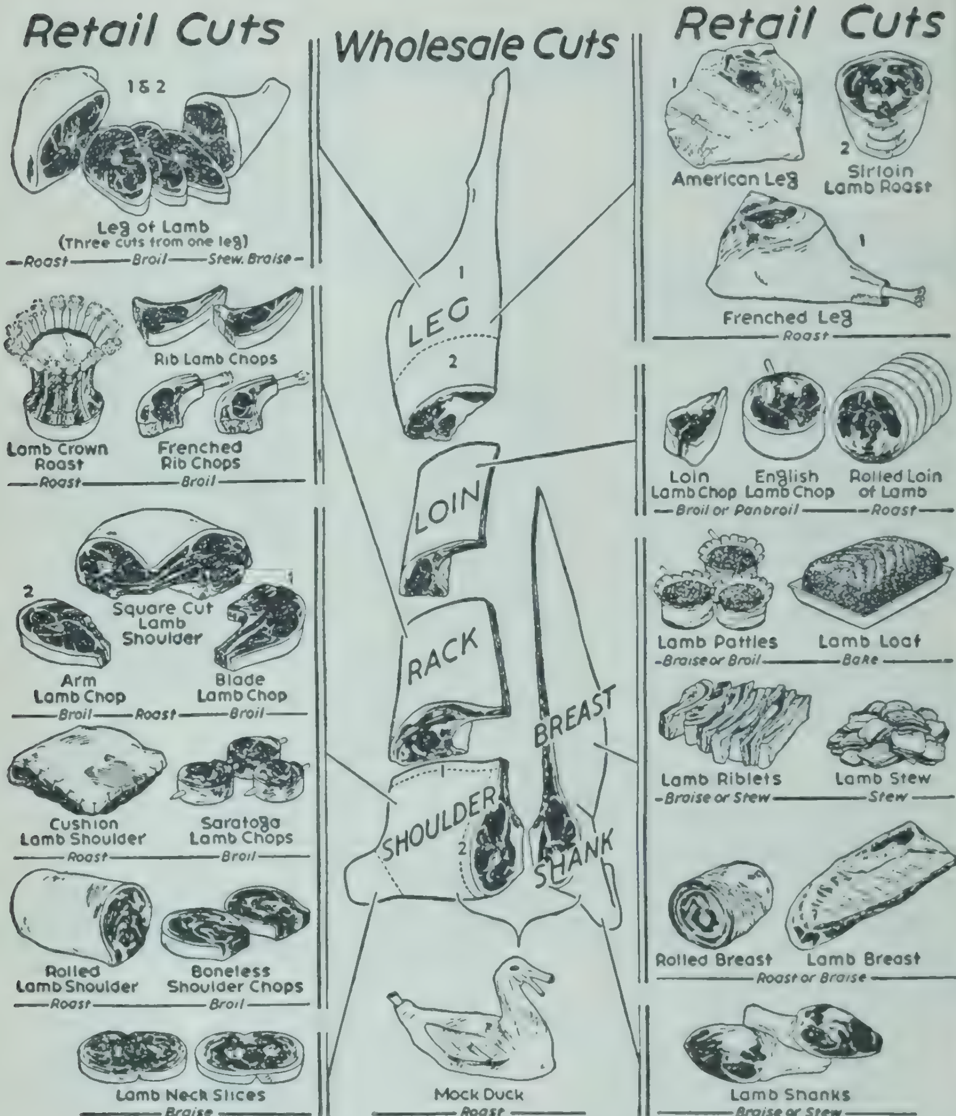
Courtesy National Live Stock and Meat Board

FIG. 42.

to range is never as tender as that from animals which have been pen fed. The meat of old animals may be tough and stringy, while that of the young animal is tender. Mature animals as a rule show richer fat deposits than immature animals and therefore meats from them have a higher caloric value.

Cooking Time. The cooking time required for meat is deter-

LAMB CHART



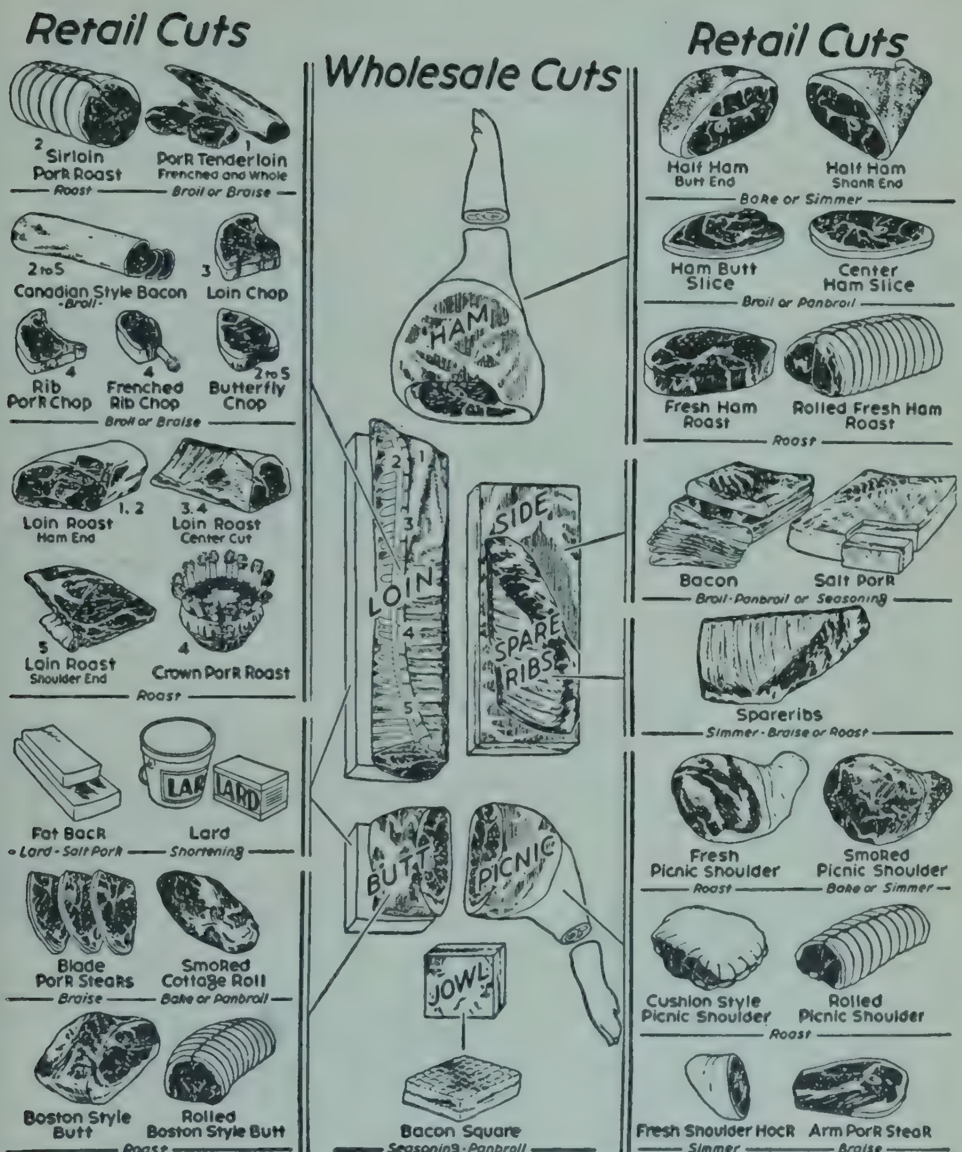
Courtesy National Live Stock and Meat Board

Fig. 43.

mined by the tenderness of the meat. As a rule, cheap cuts of meat need longer cooking than the more expensive tender cuts.

Economy. It is necessary to consider the cost of meat in terms of edible portion. Choice cuts are often expensive by reason of the fact that they contain such a high percentage of unedible material as bone and excessive fat.

PORK CHART



Courtesy National Live Stock and Meat Board

FIG. 44.

The following tables are a quick guide in the selection and use of meat, fish, and poultry.

POINTS TO BE CONSIDERED IN THE SELECTION OF MEAT

Type	Age	Characteristics and Quality	Cuts for Quick Cooking	Cuts for Roasting	Miscellaneous Cuts
Beef	Over 1 year	*Texture:* fine grain, marbled with fat *Color:* bright cherry red *Fat:* solid creamy white layers surrounding muscle fibers *Bones:* red porous indicate young animal	*Steaks* Sirloin Porterhouse T-bone Club Tenderloin Top round Loin tip Hamburg	Rib Chuck Rolled rump Bottom round Shoulder	*Long cooking* Flank steak Flank stew Brisket Neck bones Shin bones Plate
Veal	*Choice* 6 wks. to 3 mos.	*Texture:* fine grain *Color:* pinkish gray *Fat:* solid layers, fewer than in beef; clear and hard. *Bones:* porous and red	Chops: rib and loin Cutlets: top of leg Steaks	Leg Shoulder Breast	Birds Knuckle (soup)
Lamb	*Choice* 2 to 3 mos.	*Texture:* fine grain, firm *Color:* pink *Fat:* firm, white, flaky *Bones:* note break joint	Chops: loin, rib, and shoulder Steaks: top of leg	Leg Shoulder, rolled Crown rib Sirloin	Breast Shoulder
Pork	Suckling pig to mature medium-size pig	*Texture:* fine fiber and firm; minute layer of fat coating fibers *Color:* grayish pink *Fat:* smooth and white *Bones:* soft; tinged with red	Chops, loin Tenderloin	Leg Shoulder Loin	Bacon Spareribs Backbone Pig's feet Head Salt meat

SELECTION OF POULTRY

Tests for Quality	Kind	Weight Pounds	Methods of Preparation
All Poultry Head: comb red; eyes clear; no sores	Squab	¾ to 1	*Broilers* should be split down the back and cooked either under the flame or pan broiled
Breast bone: flexible; breast well fleshed in relation to bones	Broiler	Small: ¾ to 1 Regular: 1 to 2	
Wings: flexible; will spring back into place when pulled out Feet: moist, soft, flexible; not dry and scaly; toes not blunt	Fryer	1½ to 2½	*Fryers* are disjointed and dipped in batter (Chicken a la Maryland) or dipped in flour (Southern fried chicken) and immersed in hot fat.
Skin: dry, firm; age is indicated by hair on older chicken; pin feathers on young birds	Baking chicken	2½ to 3, or more	*Roast or baked chicken* cooked whole, stuffed, or unstuffed
	Duck	1½ to 4	
Fat: well distributed and not abundant	Turkey	6 to 20	
Legs: short and well fleshed; not bony and long	Fowl	3 to 6	*Fowl* may be fricasseed, or boiled

SELECTION OF FISH

Tests for Quality	Kind	Methods of Preparation
Eyes: full and bright	*Fish*	
Gills: pink	Fatty	Large fish may be baked; small fish broiled or fried
Flesh: firm and elastic; does not keep a dent when pressed with finger	Lean	
	Shellfish	Steaks and fillets from large fish broiled or sautéed
Odor: clean, fresh fish odor	Oysters	
	Clams	Shellfish may be steamed or flaked; oysters and clams may be cooked or served raw
	Crab	
	Lobster	
	Canned fish	Fish and shellfish may be used for chowders
	Dried fish	

Care of Meat, Poultry, and Fish. Meat of all kinds should be unwrapped before placing in the refrigerator. It should be wiped with a clean cloth before cooking. Cut surface of meat such as beef loses valuable flavoring materials when washed under running water. Fish and poultry are better protected from such losses and may be held under running water during the process of dressing and drawing. Fish should be kept in a closed container in the re-

frigerator because of its odor. It requires a lower temperature than meat to prevent spoilage.

Meat, poultry, and fish are preserved for use in a variety of ways. Cold storage is a common method of preventing spoilage. Freezing is now being used to advantage not only by wholesale firms, but also by family groups in rural communities where lockers are available for frozen foods. Canning is an effective and simple means of meat preservation whenever pressure canners are available. Salting, smoking, and drying are the oldest known methods of preservation.

Principles of Cookery. Meat is cooked in order to improve the flavor, increase digestibility, and destroy harmful bacteria. Meat may be cooked by dry or moist heat. It is especially important to cook pork until no tinge of pink remains in the meat itself or along the bone. Trichinella infestations are common in pork and may cause serious illness unless the parasite is destroyed by thorough cooking of the meat. Careful handling of meat is necessary at all times in order to avoid contamination with pathogenic organisms.

Dry heat, which includes such processes as oven or pan broiling, and baking in an oven or roasting over live coals or electrically heated wires, is used for tender cuts of meat. Moist heat, as exemplified by simmering, stewing, and braising, is applied to tough cuts of meat.

The proteins of meat coagulate below the boiling point of water and become tough when subjected to high temperatures for a long time. The best roasted meats are obtained by using moderate oven temperatures throughout the roasting process in preference to an initial searing; the finished product is more tender and shrinkage will be less. In a like manner the tougher cuts of meat should be simmered rather than boiled.

Tough cuts of meat may be made more tender by grinding, pounding, or scraping so that the connective tissue is broken up or partially eliminated. Meats may be tenderized by a special patented process employed by certain wholesale firms. They are also made more tender by marination, that is, by allowing them to stand in vinegar to soften the connective tissue. Methods for preparation of meats are given in detail in the section on recipes, page 624.

PROJECT

Complete the following table:

	Cost per pound	Protein per pound A.P., Gm.	Cost per 100 Gm. protein
Lamb chop		83	
Lamb neck		66	
Pork shoulder		59	
Pork loin chop		70	
Beef flank steak		77	
Beef sirloin		75	
Beef rib roast		69	
Beef round		88	

REVIEW QUESTIONS

1. What foods are included in the general term meat?
2. Describe the composition of meat.
3. List the factors which determine the quality of meat.
4. What factors should be noted especially when selecting poultry? fish?
5. Why are not all cheap cuts of meat necessarily economical?
6. How may meat be preserved?
7. Which is the more difficult to preserve, meat or fish?
8. Why is it important to cook pork thoroughly?
9. Name the cuts of meat you would select for preparing the following: Swiss steak, meat ball, fillet mignon, beef stew.

CHAPTER L

Meal Planning

The partaking of food is not only a necessity of life but it has become a means for pleasurable social intercourse as well. Chapter XI has dealt with the importance of intelligent choice of foods for adequacy and economy, while considerations of national and religious customs related to the dietary have been discussed in Chapter XII.

Meal planning is both an art and a science — an art in the skillful blending of colors, textures, and flavors, and a science in the wise choice of foods for optimum nutrition and digestibility. Careful attention must also be given to the likes and dislikes of the family group, to the amount of time which the homemaker can use for food preparation, and to the equipment which is available. A few simple well prepared nutritious dishes are much more satisfactory than a number of elaborate poorly cooked ones.

Considerations for the Family. Planning meals for the family group entails a consideration of the needs of each individual. Obviously, a young child will not be allowed the wide choice of foods given to adults. The amount of food for the overweight individual will be considerably less than that of the hard-working underweight person. The adolescent child, the elderly person, the pregnant woman, or the sick individual, each has his specific needs. However, one can readily adapt the family menu to meet these needs if care is exercised in planning meals. For example, if steak appears on the menu for the adult members of the family, a meat patty would be suitable for the young child. A baked apple is readily prepared for the child at the same time an apple pie is being baked. The same salad can usually be used for both the overweight and underweight members of the family if the dressing is omitted for the former.

Preparation Time. The wise expenditure of time in the prepa-

ration of meals should be urged. If very elaborate menus are planned an undue amount of time is spent in the kitchen—hours much better spent by the homemaker with her family, or by the nurse with her patient. A carefully prepared schedule of kitchen activities together with a convenient placement of kitchen equipment and food supplies results in a great saving of time.

Satiety Value of Foods. A satisfying meal is one which will allay the sense of hunger until almost time for the next meal. A breakfast of orange juice and toast may pass through the stomach in such a short time that a sense of hunger and fatigue quickly appears. The addition of cereal and egg will, however, postpone the appearance of these sensations.

Protein foods such as meat and eggs are high in satiety value as are foods cooked with fat. Carbohydrate foods, fruits, vegetables, and liquids are somewhat low in their staying power. The choice of foods will then depend upon the interval between meals, long intervals demanding those of higher satiety value.

Food Combinations. The first appeal to appetite is through the eye. Attractive color combinations are important, for food must look good enough to eat. Chicken à la King, mashed potato, cauliflower are monotonous in appearance whereas changing the cauliflower to green peas or beans would add color appeal. Variations in texture, temperature, and flavor are equally important. For example, a meal made up of meat loaf, mashed potatoes, stewed squash, white bread, and baked custard would be greatly improved by changing the vegetable to one requiring some mastication and by adding a crisp green salad and crusty rolls. A judicious mixture of soft and crisp foods, of bland and sharp flavors, hot and cold dishes, garnishes and relishes, greatly enhances the interest of a meal.

A very common error in meal planning is that of emphasizing one type of food to the exclusion of others. A meal containing roast beef, macaroni and cheese, and custard predominates in protein, while spaghetti, potatoes, and cake in another meal would be equally bad because of the preponderance of carbohydrate.

Even the season of the year requires some consideration, for on a cold winter day proteins and fats may be quite desirable because of their staying power and their stimulation to the metabolism. In the middle of the summer a lighter repast is usually preferable.

Food	Type		Ways to Use
Milk	Whole fresh	As beverages	Plain, buttermilk, skimmed, acidophilus Cocoa, chocolate, chocolate malted milk Shakes With carbonated bottled beverages
		As soups	Vegetable milk soup Oyster or clam Chowders Borsch (soured milk or cream)
		With cereals	Poured over cereal (plain or top milk) Cooked in cereals (half milk, half water) Bread or crackers and milk Rice baked in milk
		As desserts	Junket, Junket ice cream Custard: soft, baked or frozen Rice or other starchy puddings Sherbets Blueberries and other berries with milk
	Dried	As substitute for fresh	Breadmaking Prepared foods at home or commercially In soups
	Evaporated*	As substitute for fresh	In cases of lack of refrigeration In certain milk formulas for infants Where economy is necessary: best used in coffee, soups, and prepared dishes
Cream	Heavy	As garnish	For soup (topping) For fresh or canned fruits (topping) For gelatin jellies (topping)
		As beverage	Cream, egg, and Vichy Cream, egg, and carbonated bottled beverages In eggnogs: fruit, coffee, or alcoholic
		As salads and dressings	Cream mayonnaise Horseradish dressing (for hot or cold meats) Cream, prune, and nut salad
		As desserts	In ice cream In russes (Charlotte, fruit, etc.) In mousses

* When necessary to use evaporated in place of fresh milk, one tall can containing 14.5 ounces. 17 ounces is the equivalent of 1 quart of whole fresh milk.

DIFFERENT WAYS TO USE FOODS IN THE DAILY MENU

(Continued)

Food	Type	Ways to Use	
Cheese	Cottage (curds)	As such	With cream and sugar or salt
		As salads	On lettuce with mayonnaise Combined with celery and used as stuffing for tomatoes or green peppers (served on lettuce, endive, or cress) Combined with nuts, olives, etc.
		As sandwiches	As sandwich filling with jelly
	Cream	As salads	As stuffing for green peppers, combined with nuts Stuffing for pears or pineapple As frozen salad
		As such**	As spread for crackers As sandwich filling — many combinations
		As garnish	Cheese balls Stuffed celery
	Ripened	As such	With crackers after a meal With pie
		As sandwiches	Toasted Plain
		As garnish (grated)	On soups On salads On cooked food
		Cooked dishes	Omelet Soufflé Welsh rabbit (combined with beer, egg, and condiments) Golden Buck (combined with milk and eggs)
		Combinations with other foods	Macaroni and cheese Spaghetti with cheese sauce Potatoes au gratin Potatoes with toasted cheese topping
		As salads and dressings	Pineapple and grated cheese on lettuce Celery stuffed with cheese Cheese salad dressing Roquefort dressing for lettuce

** Not used as separate diet as "curds and cream."

DIFFERENT WAYS TO USE FOODS IN THE DAILY MENU

(Continued)

FOOD	TYPE		WAYS TO USE
Eggs		As beverages	Eggnogs: alcoholic, fruit, coffee Albuminized fruit juices: orange, lemon, grapefruit, pineapple, grape 1 to 2 egg whites, 3 oz. juice, sugar, ice (if grape juice is used, add 1 tbsp. lemon juice) Egg and fruit juices 1 whole egg, 3 oz. orange or other juice 1 tbsp. lemon juice, ice, sugar Egg malted milks Plain malted milk plus cream if desired Malted milk chocolate (add 1 tbsp. lactose if calories are to be increased — 1 tbsp. lactose = 40 calories) Egg and sherry (wine): 1 egg, 1 oz. wine
		As chief protein dish	Soft, poached, coddled Scrambled: plain; with tomatoes; with tomatoes, peppers, and pimentoes; with cream; with breadcrumbs Baked, in individual baking dishes or several in large baking dish Scalloped: hard cooked, diced, and arranged in layers in baking dish with alternate layers of cream sauce and breadcrumbs Creamy egg: mixed with ½ cup milk, small lump butter, beaten and cooked in double boiler until consistency of custard — pour over cubes of toast Omelet: foamy; plain; with tomatoes; with green peppers, tomatoes, and parsley; Spanish; French Eggs Goldenrod Ham and eggs Bacon and eggs
		As salads	Egg and asparagus with mayonnaise or cooked dressing Hard cooked or deviled with mayonnaise Combined with cheese, chicken, flaked fish, or potato
		As desserts	Custard: soft, baked, caramel, frozen Omelet: pineapple, jelly Cake: sponge, Angel Food

DIFFERENT WAYS TO USE FOODS IN THE DAILY MENU
(*Continued*)

<table>
<tr><th colspan="4">Food</th></tr>
<tr><th colspan="4">Vegetables</th></tr>
<tr><th colspan="3">Fresh or Canned</th><th>Dried</th></tr>
<tr><th>Green — Leafy</th><th>Yellow</th><th>Others</th><th>Legumes</th></tr>
<tr><td>Beet Greens
Brussels sprouts
Cabbage
Chard
Dandelion greens
Escarole
Kale
Mustard greens
Spinach
Turnip greens</td><td>Carrots
Corn
Potatoes, sweet
Squash
Turnips</td><td>Asparagus
Beans: string, Lima
Beets
Cauliflower
Celery
Corn, white
Cucumbers
Eggplant
Onions
Peas, green
Peppers
Potatoes — white
Radishes
Tomatoes</td><td>Beans
Lentils
Peas</td></tr>
</table>

<table>
<tr><th colspan="2">Type</th><th colspan="2">Ways to Use</th></tr>
<tr><td rowspan="3">Cooked*</td><td>As such</td><td>Served with butter or substitute
Served with white sauce
Scalloped — crumbs and butter, baked</td><td rowspan="5">Beans: baked with salt pork, molasses, or brown sugar; boiled with or without meat, flavored with chili sauce or ketchup if desired; scalloped with butter and bread crumbs; in soup, cheese added if desired (split pea, black bean, etc.); in sandwiches
Lentils</td></tr>
<tr><td>As soups</td><td>White or milk
Vegetable
Tomato bouillon
Minestrone (with cheese)
Borsch (beet)</td></tr>
<tr><td>As salads</td><td>Combined with nuts, cheese, eggs, fruit, meat, fish, or chicken
Slaw
Combination</td></tr>
<tr><td rowspan="2">Cooked or raw</td><td>As sandwiches</td><td>Cucumber
Tomato and lettuce
Tomato and cress</td></tr>
<tr><td>As relishes, garnishes, pickles</td><td></td></tr>
</table>

* Cooked in as small an amount of water as possible and in a tightly closed vessel.

(*Continued*)

FOOD

Fruits FRESH OR CANNED	DRIED	Miscellaneous Sweets
Apples	Apples	Honey
Apricots	Apricots	Karo
Bananas	Dates	Molasses
Berries	Figs	Maple syrup
Grapefruit	Peaches	Marmalade
Lemons	Prunes	Preserves, jellies, jam
Oranges	Raisins	Sorghum
Peaches		Sugar: brown, maple, white
Pears		
Pineapple		
Rhubarb		
Tomato (to alternate with fruit)		

TYPE — WAYS TO USE

Type	Ways to Use (Fresh or Canned)	Ways to Use (Dried)	Ways to Use (Miscellaneous Sweets)
As breakfast fruit	As such As juice On cereals	As such Stewed In candies In cakes In puddings In pies In cobblers	Molasses: in cookies, cakes, baked beans, gingerbread: as spread for bread; on waffles, fried cakes, etc. Honey and maple syrup: used as molasses above with exception of baked beans Sugar: used in all desserts except when saccharin is called for, in candy, in jelly and preserves, in jam, in cakes; to sweeten cereals, beverages, fruits, etc.
As desserts	Frozen In ice cream In mousse In gelatin In pie, pudding In shortcake In fruit rolls In dumplings In cobblers		
As salads	Combined with nuts, cheese Plain		
As sandwiches	Combined with nuts, cheese, peanut butter		
Preserved	Jellies Jams Preserves Conserve		
As sauces	Pudding Ice cream Meat With eggs as omelet		

DIFFERENT WAYS TO USE FOODS IN THE DAILY MENU
(*Continued*)

Food	Type	Ways to Use	
Cereals	Whole-grain	As breakfast foods	Grapenuts, Rolled Oats, Pettijohn's, Ralston's, Wheatena; brown rice; wheat — cracked, flaked, or shredded, with milk and fruit Gruels, oatmeal, etc., with milk and fruit if desired
		As fried cakes or pones	Fried mush or fried cakes, served with sweet; water bread fried or baked in pones Fritters
	Refined	As breakfast foods	Cream of Wheat, Farina, corn-meal mush (cooked with water or milk — half and half) Cornflakes Rice flakes
		As main dish	Macaroni, spaghetti, noodles—combined with meat, poultry, fish, cheese, eggs, tomatoes Fried mush Hominy (grits)
		As desserts	Cookies with raisins, nuts, candied fruits Puddings: tapioca, rice, cornstarch, etc., plain or with fruit added
Breads	Whole - grain wholewheat, graham, oatmeal, rye, corn-meal Refined white flour, white and yellow corn - meal (fine)		
	Sliced*	As such	Served with butter or substitute, jam, jelly, marmalade, peanut butter, molasses
		As sandwiches	Minced ham, chicken, fish, American cheese, or cream cheese with jelly Relishes (hors d'oeuvrés) Vegetables — lettuce, tomato, cucumber, with or without bacon

* Average slice=30 gm. ($3\frac{1}{2}$x$3\frac{1}{2}$x$\frac{3}{8}$ in.) ; medium slice=20 gm. ($3\frac{1}{2}$x$3\frac{1}{2}$x$\frac{1}{2}$ in.) ; thin slice=15 gm. ($3\frac{1}{2}$x$3\frac{1}{2}$x$\frac{1}{8}$ in.).

DIFFERENT WAYS TO USE FOODS IN THE DAILY MENU
(Continued)

Food	Type		Ways to Use
Breads (*Con.*)	Sliced (*Con.*)	As toast	Dry, Melba, buttered, milk or cream (latter is toast covered with thin white sauce) Used as base for serving creamed meats, eggs, chicken, fish, sweetbreads, asparagus, etc.
	Hot Breads	As such	Batter bread Johnny cake Spoon bread Crackling bread
		As biscuits	Plain Cheese Filled with meat (pastries) or fruits
		As muffins	Plain or vanilla Sweet, filled with fruits such as raisins, dates, blueberries or with nuts
		As pancakes, etc.	Pancakes: flour, meal, rice, buckwheat Waffles, plain or pecan
	Crackers	As such	White, soda, saltines, graham, oatmeal, wholewheat, arrowroot, Ry-Krisps, sweet crackers, butter thins, cheese crackers
Flour, Meal	White, whole-grain Cakes and cookies		Used in all breads, crackers, etc. listed above Thickening for soups, gravies, puddings, etc.
Meat Poultry Fish	Meat	As such	Scraped beef, beef juice, beef tea Steaks, chops, cutlets, roasts Stew meat, with vegetables or dumplings Hash, with potatoes Ground: sausage, Hamburger, meat loaf Cold cuts Stuffed breast of veal Sandwich filling Corned beef: with cabbage; New England boiled dinner with potatoes, carrots, beets, onions, turnips Backbone, spareribs, hogshead cheese, scrapple (pork) Tongue

DIFFERENT WAYS TO USE FOODS IN THE DAILY MENU
(Continued)

Food	Type	Ways to Use	
Meat Poultry Fish (*Con.*)	Meat (*Con.*)	As soup	Stock Clear soup Broth
		As croquettes	Veal Pork
		Vital organs	Kidneys — stew, etc. Sweetbreads, breaded, creamed Heart, stuffed Liver: with bacon, liver loaf, liver cocktail Tripe
	Poultry	As such	Roasted, fricasseed, broiled (young birds), smothered, fried Stewed with rice, dumplings, or noodles Creamed, or à la King, served on toast
		As soups	Broth Consommé
		As salads	Plain, with grapes, filling for tomatoes and sandwiches (pork and veal frequently added)
		As sandwiches	Sliced, hot or cold Chicken salad
	Fish	As such	Baked, broiled, or fried Fish balls or cakes with potato Scalloped with bread crumbs Fish loaf (salmon, etc.) Fish pudding
		As salads	Tuna Salmon
		As chowders	Clam, shrimp, etc.
	Shellfish	As such	Raw, steamed, stewed, fried, scalloped, creamed, baked (oysters, clams, shrimps, crabs, lobsters) Lobster Newburg Crab Newburg Stuffed crabs Lobster or crab croquettes Shrimp Creole

DIFFERENT WAYS TO USE FOODS IN THE DAILY MENU
(*Continued*)

Food	Type	Ways to Use	
Meat Poultry Fish (*Con.*)	Shellfish (*Con.*)	As hors d'oeuvres	Pigs in blankets: (oysters wrapped in bacon)
		As cocktails	Oyster, shrimp, clam
		As soups and chowders	Oyster or clam broth Oyster or clam chowder
		As salads	Lobster, crab, shrimp
Miscellaneous Butter Peanut butter Bacon Salad oils Fats Chocolate Cocoa	Butter	As such	Spread for bread On cereals, vegetables, hot cakes, macaroni, and noodles In cakes and puddings
		As sauces	As substitute for salad oil in some cooked dressings, or As parsley lemon butter for meat and fish As hard sauce and other dessert sauces
	Peanut Butter	As such	Spread for bread or crackers
		As sandwiches	Plain, or combined with raisins, dates, or other dried fruit, marmalade, or jam
		As sweets	In cookies and candies
	Bacon	As such	With eggs, with fried apples, with liver
		As hors d'oeuvres	Pigs in blankets: (oysters wrapped in bacon and fried)
		As sandwiches	With tomatoes, chicken, lettuce, etc.
	Chocolate and cocoa	As beverages with cream and milk As candy As syrups for making chocolate milk; sauces for ice cream, cakes, and puddings As sweets in cakes and cookies	

Meal Patterns. Menus should be planned for several days at the time rather than meal by meal if one wishes to obtain balance, variety, and interest. The preceding arrangement of the so-called staple foods which must be included in the daily menu in order to meet the nutritional requirements of individuals or family groups should render meal-planning more simple. In a country as large as

ours it is reasonable to expect a great diversity of meal patterns. They will vary with the family's activities, nationality, customs, hours at which meals are eaten, and economic factors. No single meal pattern can be judged without consideration of the meals of the whole day. The following discussion is intended to be a guide rather than a set rule.

Breakfast. The foods which comprise this meal are relatively few in number. For some purposes a light repast of fruit, bread or cereal, and beverage is adequate, whereas for very active individuals additions may include eggs, bacon or other meat, and sometimes even potatoes or hominy grits.

Some people omit breakfast and others eat very lightly in the morning. Such practices should be discouraged since a substantial meal at this time of day is imperative if the school child and the hard-working adult alike are to meet the activities of the day with vigor and enthusiasm. A good breakfast helps to overcome the shortcomings of many inadequate and hurriedly eaten luncheons.

TYPE DIETS FOR BREAKFAST

Light	*Medium*	*Heavy*
Fruit	Fruit	Fruit
Cereal or toast	Cereal or toast	Cereal
Butter or fortified margarine	Eggs	Toast or rolls
Beverage	Butter or fortified margarine	Butter or fortified margarine
	Beverage	Eggs or bacon or both
		Beverage

Luncheon. This meal is apt to be an extremely variable one. Children in school, men at work, and homemakers with small children may have quite varying sources of food. If a lunch is carried to school or work it should always contain milk in some form — either plain or in soups. Sandwiches made with a variety of fillings such as cheese, egg, meat, peanut butter, or vegetables will no doubt constitute the main food in the lunch box. Fresh fruit or vegetable such as orange, tomato, celery, raw carrots should be used daily.

Many workers who eat away from home make it a practice to eat hasty luncheons or merely to partake of "snacks" at quick-lunch counters or soda fountains. It is extremely difficult to compensate for the marked inadequacies of such meals.

For those who eat luncheon at home the meal may be a fairly simple one, or one which is more complicated. The following plans require a minimum of time for preparation.

TYPE DIET FOR LUNCHEON	SAMPLE MENU
I Soup	Cream of Tomato Soup
Sandwiches	Chopped egg with mayonnaise on
Fruit, preferably raw	Wholewheat bread
Milk	Milk
	Half grapefruit
II Legumes, eggs, meat, or fish with	Baked beans with pork
Starchy food	Combination salad
Salad	French dressing
Bread with butter or fortified margarine	Wholewheat bread
Milk	Butter
Fruit or plain dessert	Milk
	Sliced banana with milk or cream

Dinner. The chief meal of the day may be served at noon or at night depending upon family custom. It must make up any lack which may have occurred in the other two meals. As a rule meat, fish, or fowl comprises the main dish. Potatoes or a starchy food and a green or yellow vegetable are generally served with the meat. If no salad has been included in the luncheon it should be given here. The dessert may consist of puddings, cake, ice cream, pastries or fruit. Milk should again be given to the children. For more elaborate meals one may also include an appetizer such as a clear soup, or fruit cup.

TYPE DIET FOR DINNER	SAMPLE MENU
Meat, fish or poultry	Broiled salmon
Potato or substitute	Creamed whole potato
Vegetable, green or yellow	Fresh peas
Salad — if none at lunch	Lettuce, grapefruit, and celery salad
Bread, whole-grain or enriched	French dressing
Butter or fortified margarine	Parker House rolls
Dessert	Vanilla ice cream
Beverage	Coffee
	Milk for children

The following meals are given to show the same food value at three levels of expenditure.

MEALS ACCORDING TO COST

Low	Moderate	Liberal
	BREAKFAST	
Choice of Oatmeal with milk and sugar Corn-meal mush with milk and sugar	Oatmeal with cream and sugar or Ralston's	Shredded Wheat with cream or Ralston's with cream
Prunes (5 small)	Orange (1 whole)	Strawberries
Bread, wholewheat (2 slices) with butter or substitute	Bread or toast with marmalade and butter	Toast or muffins with butter and marmalade
	Egg (1 whole)	Bacon and egg
Coffee or tea with milk and sugar	Coffee or tea with cream and sugar	Coffee or tea with cream and sugar
	LUNCHEON OR SUPPER	
Macaroni with cheese	Macaroni with cheese	Creamed chicken and mushrooms on toast or rice
Coleslaw	Sliced tomatoes with mayonnaise	Stuffed tomato with mayonnaise
Bread, wholewheat (2 slices) with butter	Bread, whole-grain (2 slices) with butter	Wholewheat rolls (2) with butter
Apple	Baked apple or applesauce with cream	Apple float with custard
Milk	Milk	Milk
	DINNER	
Meat stew: meat, potatoes, carrots, onions, tomato*	Clear soup (broth) with two crackers	Consommé with two crackers
Bread, wholewheat (2 slices) with butter	Roast beef (1 serving)	Broiled or planked sirloin steak
Banana	Potato baked or boiled	Parsley potatoes
Gingerbread	Buttered carrots	Glazed carrots
Coffee if desired	String beans	Lettuce or escarole with Roquefort cheese dressing
	Bread (1 slice)	Roll and butter
	Fruit gelatin with cream	Fruit ice
	Plain cake	Frosted cake
	Coffee	Coffee

* Tomato may be added to stew or used as cocktail (juice).

SUMMARY

1. Skillful meal planning requires careful consideration of adequacy, economy, racial and religious factors, satiety value, and food combinations.

2. Protein foods and foods cooked in fat stay in the stomach a relatively long time and therefore have a high satiety value.

3. Food combinations should be selected for their color interest, and variety in flavor, texture, and temperature. The use of protein foods alone, or of carbohydrate to the exclusion of other nutrients, should be avoided.

4. Meal patterns should be adapted to the individual family. The objectives in meal planning are most easily attained if the meals for the day are planned ahead of time as a single unit.

PROJECTS

1. Plan three palatable and nutritious box lunches for a school child. Modify these menus for a man who works in a factory.

2. Plan adequate low-cost menus for a family of five for one day. The family may consist of the following members: father who is engaged in a very active occupation; mother who is 35 pounds overweight; a boy of 17 years in high school; a girl of 12 years; and a boy of 2 years. Indicate the amounts of food necessary for each individual if the needs of normal nutrition are to be met.

3. Plan low-cost menus and market orders for the above family for one week. Indicate the amounts of each food which must be purchased.

REVIEW QUESTIONS

1. Why are the following poor examples of meal planning in any given meal?

Creamed codfish and mashed potato
Pork chop, fried potato, chocolate pie with whipped cream
Cream of tomato soup and tomato salad
Lima beans and peas
Foamy omelet and mashed yellow turnips
Pot roast and tuna fish salad

2. Name five ways in which each of the following foods may be used in meals: eggs, milk, American cheese, apples, carrots, beef.

3. What advantages are there to planning meals in advance?

4. What factors must be kept in mind in planning of meals? Be able to give good and bad examples of each of the points to remember in meal planning.

SECTION V

Recipes

CHAPTER LI

Introduction to the Use of Recipes

One of the very important duties of the nurse is that of correctly feeding the patient to meet his body requirements. However, the nurse usually has very little time available for the preparation of food, so that it is advisable to use as much of the family menu as possible. Whenever necessary, one can supplement these foods with special dishes. Even though the nurse does not always prepare the food for the patient's tray she should be able to direct such preparation. She should always present to her patient a tray which is attractive in appearance, and pleasing to the taste.

The recipes which are listed in this section are for individual portions unless otherwise noted. They are easily prepared and should require a minimum of the nurse's time. It is not reasonable to expect the nurse to prepare elaborate dishes — pastries, cakes, and bread — which require that much time be spent away from the patient. Hence, such recipes have not been included here. A few family size recipes have been listed primarily to serve as a guide to the public health nurse who may be asked to assist in menu planning for family groups. It is expected, of course, that the public health nurse in need of such information will avail herself of the many government and welfare bulletins as well as cookbooks that are to be had.

One cannot hope to achieve good results in cookery unless the directions for the preparation of foods are completely understood and explicitly followed. The nurse should read the following paragraphs carefully and be familiar with their content before she attempts to cook for patients.

Methods of Cookery. 1. Boiling is cooking in water at 212° F. or 100° C. The bubbles break rapidly on the surface of the water.

2. Simmering is cooking at a temperature below the boiling point

— approximately 200° F. or 93° C. The bubbles of steam slowly rise to the surface of the vessel.

3. Stewing is cooking for a long time at about 200° F. It is used for tougher cuts of meat. The liquid is sometimes thickened.

4. Broiling is cooking by direct heat from a gas flame, electric wires, or live coals. It is usually used for tender cuts of meat and the temperature is high enough to quickly sear the surface.

5. Pan broiling is cooking in a hot metal pan on top of the stove without the use of fat.

6. Baking is cooking in an oven using an open or covered pan. The oven roasting of meats is really a baking process. The most commonly used oven temperatures are as follows:

Slow = 250° to 350° F.
Moderate = 350° to 400° F.
Hot = 400° to 450° F.
Very hot = 450° to 500° F.

7. Frying is cooking by immersion in hot fat at 350° F. to 400° F.

8. Sautéing is cooking in a small amount of fat in a frying pan, the food being turned frequently.

Measurements. If correct measurements are to be made it is essential that a standard eight ounce measuring cup divided into fourths and thirds, and standard measuring spoons be available. All measurements are level; that is, the spoon or cup is filled to the brim and the top leveled off with a knife. If the cup has an added space above the full-cup measure to prevent spilling, one should note that fact, to avoid errors in measurement.

White flours should be sifted before measuring and placed in the cup by spoonfuls, rather than dipped out with the cup. Tapping the cup or shaking it to level it off should be avoided.

Butter, lard, or other solid fat is more easily measured by using cold water in the process. For example, if one fourth cup is desired, fill cup three fourths full of water and add fat until water rises to the full-cup mark. Melted fat has the same fat content as solid fat — one tablespoon of butter is the same whether melted or hard.

To measure one half of a spoonful, if standard measuring spoons are not available, fill spoon and level off, divide contents lengthwise with a knife, and remove unnecessary portion.

ABBREVIATIONS

Metric	Household
Kilogram — kg.	Teaspoon — tsp. or t.
Liter — l.	Tablespoon — tbsp. or T.
Gram — Gm.	Pint — pt.
Milligram — mg.	Quart — qt.
Cubic centimeter — cc.	Ounce — oz.
	Pound — lb.
	Cup — C.

MEASURES AND WEIGHTS

3 teaspoons = 1 tablespoon	4 quarts = 1 gallon
16 tablespoons = 1 cup	2 gallons = 1 peck
2 cups = 1 pint	4 pecks = 1 bushel
2 pints = 1 quart	16 ounces = 1 pound

The following relationships are approximately correct for water and milk:

1 gram = 1 cubic centimeter
1 teaspoon = 5 cc. = 5 Gm.
1 tablespoon = 15 cc. = 15 Gm.
2 tablespoons = 30 cc. = 30 Gm. = 1 oz.
16 tablespoons = 240 cc. = 240 Gm. = 8 oz. = 1 cup
A kilogram equals 2.2 pounds
28.35 grams = 1 ounce (approximate measure for convenience is 30 grams)
1 pound = 453.6 Gm.
To convert ounces to grams, multiply the ounces by 30 (or 28.35)
To convert gm. to ounces, divide the gm. by 30 (or 28.35)
To convert pounds to kilograms, divide the pounds by 2.2
To convert kilograms to pounds, multiply the kilograms by 2.2

All foods do not weigh or measure alike. The following list shows the weight and measure of some of the most commonly used ones:

2 tbsp. butter	= 1 oz.	8 medium size eggs	= 1 lb.
2 cups butter	= 1 lb.	10 eggs (without shells)	= 1 lb.
2 cups granulated sugar	= 1 lb.	2 cups rice	= 1 lb.
2½ cups powdered sugar	= 1 lb.	2⅔ cups oatmeal	= 1 lb.
4 cups sifted flour	= 1 lb.	4¾ cups rolled oats	= 1 lb.
1 pint milk or water	= 1 lb.	4 tbsp. fat	= 2 oz.
		2 tbsp. sugar	= 1 oz.
		4 tbsp. sifted flour	= 1 oz.
		4 tbsp. powder'd coffee	= 1 oz.

CHAPTER LII

Beverages

All beverages serve a common purpose in that they introduce fluid into the body. While certain beverages are used primarily to relieve thirst, there are others which bring nourishment into the body and constitute what is known as a "liquid diet." They may be good sources of protein, carbohydrate, or vitamin C depending upon the constituents used in their preparation. Certain beverages serve an important purpose in the dietary because of their stimulating properties.

Suggested Reinforcements. Calories: 1. Coffee cream may be substituted for milk.

2. Glucose or lactose may be used instead of cane sugar. Because the former sugars are less sweet, two to three teaspoons of these sugars may be used for each teaspoon of cane sugar, thus increasing the caloric value of the beverage. Lactose does not dissolve readily; hence, it should be heated in the liquid in order to effect solution.

Protein: 1. One to two tablespoons of dried milk may be added to each glass of milk beverage.

2. Egg white may be used in fruit juices or in milk beverages.

TEA

Tea is made by infusion; that is, it is never boiled.

Allow one level teaspoon tea or one tea ball to each cup of boiling water. After scalding pot, pour boiling water over leaves, cover closely, and allow to stand from one to three minutes according to the strength desired. Serve immediately with sugar, lemon, cream, or milk. Tea should never be reheated.

TEA WITH GELATIN

2 teaspoons gelatin
2 tablespoons cold water
1 cup steeped tea

Method. Soak gelatin in water. Pour hot tea over gelatin. Stir until dissolved and serve at once with lemon and sugar.

ICED TEA

Prepare hot tea by using a double quantity of tea leaves. When steeped, pour over crushed ice. Garnish with a slice of lemon or a sprig of mint. Serve with lemon or cream, and sugar.

GINGER TEA

1 cup boiling water
$\frac{1}{2}$ teaspoon powdered ginger
1 to 2 teaspoons sugar
1 tablespoon milk or cream

Method. Pour boiling water over ginger, strain, add sugar and milk. When milk is omitted use $\frac{1}{3}$ teaspoon ginger instead of $\frac{1}{2}$ teaspoon.

BOILED COFFEE

2 tablespoons ground coffee
$\frac{1}{4}$ cup cold water
2 teaspoons egg white
1 cup boiling water

Method. Mix coffee with egg white and half of the cold water, place in pot, and pour boiling water over coffee. Allow to simmer for three minutes. Remove from direct heat and add remaining cold water to settle grounds. Allow to steep from five to seven minutes. Strain and serve in heated coffee pot.

PERCOLATED COFFEE

2 tablespoons finely ground coffee
1 cup water

Method. Place coffee in upper part of pot, water in lower section, and put over flame, or attach plug if electric percolator is used. When percolation begins, lower flame so that the process will continue slowly rather than violently. The strength of the beverage depends upon the length of time it is allowed to percolate.

Such coffee substitutes as Kaffee Hag and Sanka are prepared in a similar manner.

DRIP COFFEE

2 to $2\frac{1}{2}$ tablespoons pulverized coffee
1 cup water

Method. Place coffee in top portion of pot and set pot in a warm place. Pour the boiling water over the coffee, cover, and allow to filter through. Serve immediately in a heated pot.

VACUUM DRIP COFFEE

Place measured amount of water in bottom part of coffee maker. For each cup of water put two tablespoons finely ground coffee in funnel. Place pot over heat. As soon as water has risen into the funnel, remove from heat and allow to stand in warm place. The vacuum formed in the bottom part of the pot will cause steeped beverage to flow down in a minute or so. Remove funnel and serve at once.

INSTANTANEOUS COFFEE

1 teaspoon or more coffee	1 cup boiling water

Method. Place Instant coffee or substitute in cup and add freshly boiling water; stir until dissolved. Serve with sugar and cream.

Postum, a coffee substitute, is prepared in a similar manner.

COCOA

2 teaspoons cocoa	¼ cup water
1 to 2 teaspoons sugar	¾ cup milk

Method. Mix cocoa with sugar and water. Cook to a thick syrup using top part of double boiler over direct flame. Add milk and cook over hot water to the scalding point. Beat briskly with a Dover beater to avoid formation of scum. Serve with or without whipped cream.

Reinforcements. Protein: 1. The whole or yolk of one well beaten egg may be added. Care must be observed when the white of the egg is used that the liquid is not sufficiently hot to coagulate the albumin.

2. One to two tablespoons of dried milk may be mixed with the sugar and cocoa.

HOT CHOCOLATE

¼ square bitter chocolate	¼ cup boiling water
1 tablespoon sugar	¾ cup milk

Method. Melt the chocolate in double boiler, stir in the sugar and water gradually, and boil one minute over direct flame. Add milk, heat over hot water to scalding point, and beat briskly with

egg beater until beverage is smooth. This may be served with whipped cream, or a marshmallow may be placed in cup before pouring the chocolate.

CHOCOLATE SYRUP

1 cup water
½ cup sugar
1 square chocolate, grated
Few grains salt
½ teaspoon vanilla

Method. Cook all ingredients, except vanilla, slowly until the syrup is the consistency of a thin cream sauce. Cool and add vanilla.

This syrup may be made for use as a sauce on puddings or ice cream, or to flavor milk beverages. It should be stored in a refrigerator until it is to be used.

MILK AND GINGER ALE (OR SARSAPARILLA)

⅓ cup milk
⅓ cup ginger ale or sarsaparilla

Method. Pour into a milk shaker and shake with cracked ice until foamy.

ALBUMINIZED MILK SHAKE

¾ cup milk
1 tablespoon sugar
¼ teaspoon vanilla
1 egg white

Method. Place the milk on ice to become thoroughly chilled. Clip the egg white with a scissors or a silver knife and fork; add to milk, sugar, and vanilla. Strain through cheesecloth to remove strings of egg.

If the patient does not object to foam, the milk and other ingredients may be placed in shaker and shaken four to five minutes, and then poured over cracked ice.

Variations. This beverage may be flavored to suit the taste of the patient. Vanilla, caramel, or coffee may be used to give variety.

MILK PUNCH

½ cup milk
¼ cup cream
1 egg white
1 tablespoon whisky, sherry, or
2 tablespoons strong coffee
2 to 3 teaspoons sugar
Few grains nutmeg

Method. Place ingredients in shaker and shake a few minutes to mix them thoroughly. Pour over cracked ice; sprinkle cinnamon or nutmeg over top.

HIGH PROTEIN MILK

2 egg whites
4 tablespoons dried milk
2 to 3 teaspoons sugar
$\frac{2}{3}$ cup milk

Method. Beat egg white until stiff but not dry. Add dried milk and sugar; mix well. Combine milk with egg-dried milk mixture. Chocolate syrup, coffee, vanilla, or caramel may be used for flavoring.

MALTED MILK

3 tablespoons malted milk
$\frac{3}{4}$ cup boiling water or milk
1 to 2 teaspoons sugar
$\frac{1}{4}$ teaspoon salt
3 to 5 drops vanilla

Method. Mix malted milk powder with one to two tablespoons water or milk. Heat liquid to boiling point (scalding point for milk), add sugar, salt, and flavoring. Add gradually to malted milk paste and beat until smooth. This may be served hot or chilled. Use cup or glass for hot or cold beverage respectively.

CHOCOLATE MALTED MILK

3 tablespoons malted milk
$\frac{3}{4}$ cup milk
$\frac{1}{4}$ cup coffee cream
2 teaspoons sugar
1 tablespoon chocolate syrup
$\frac{1}{4}$ teaspoon vanilla

Method. Mix malted milk with a little cold milk, stir into the remaining milk and cream, and add sugar and chocolate syrup. Beat briskly with rotary egg beater for two or three minutes, or place in mixer, turn on current, and allow to run for two or three minutes. Pour over crushed ice. Chocolate malted milk may be used instead of plain malted milk, in which case the chocolate syrup is omitted.

Reinforcements. Protein: 1. Add raw egg just before placing in mixer. If rotary beater is used, beat egg yolk with sugar and chocolate syrup, add to cream and milk mixture containing malted milk, and fold in egg white last.

Calories: 1. Add one tablespoon vanilla or chocolate ice cream to finished drink.

EGGNOG

1 egg
$\frac{3}{4}$ cup milk
1–2 teaspoons sugar
Few grains salt
3–4 drops vanilla

Method. Beat egg well, and add milk, sugar, salt, and vanilla. Stir until sugar is dissolved. Strain to remove any shreds of unbeaten egg. Sprinkle with nutmeg.

Variations. One to two tablespoons chocolate syrup may be added to the eggnog for varied flavor. Malted milk powder may also be used for variety.

EGGNOG (STIMULATING)

1 egg
1 tablespoon sugar
2 tablespoons whisky or strong coffee
Few grains nutmeg
$\frac{1}{4}$ cup milk
$\frac{1}{4}$ cup cream, 35 per cent

Method. Beat yolk of egg and add sugar. Beat in whisky very slowly, using rotary beater, add milk, and mix thoroughly. Beat white until stiff and add to mixture. Whip cream separately and fold into other ingredients. Pour into glass and sprinkle with grated nutmeg. Set glass in crushed ice and serve. Never add ice to beverage.

HIGH PROTEIN EGGNOG

1 egg
$2\frac{1}{2}$ tablespoons dried milk
2–3 teaspoons sugar
$\frac{3}{4}$ cup milk
3–4 drops vanilla
Few grains nutmeg

Method. Separate egg, and beat white until stiff but not dry. Add dried milk and mix well. Beat egg yolk and add sugar and milk. Combine the two mixtures. Flavor with vanilla and nutmeg.

ORANGE OR GRAPEFRUIT JUICE

Method. Cut fruit in half across sections and extract juice with hand squeezer or electric juicer; use nonmetal squeezer. Strain

juice through coarse sieve into small fruit juice glass. About four ounces are sufficient for one serving. Place glass in bowl of crushed ice. No ice is put into the juice itself. Little if any sugar is used unless fruit is extremely acid.

KEY RULE FOR FRUITADES

Kind of Juice	Amount Table-spoons	Sugar Table-spoons	Lemon Juice Table-spoons	Crushed Ice	Water or Other Liquid
Orange	6	1	1	⅓ glass	Fill 8 ounce glass to ½ in. from rim
Pineapple	6	1	1	⅓ glass	Fill 8 ounce glass to ½ in. from rim
Grape	6	none	1	⅓ glass	Fill 8 ounce glass to ½ in. from rim
Grapefruit	6	1	none	⅓ glass	Fill 8 ounce glass to ½ in. from rim
Lemon	2-3	1	....	⅓ glass	Fill 8 ounce glass to ½ in. from rim

FRUIT PUNCH

½ cup orange juice
¼ cup pineapple juice
2 tablespoons lemon juice
1 tablespoon sugar
Enough carbonated water, or plain water, to fill glass

Method. Mix the fruit juices and sugar; pour over one third glass crushed ice. Peach, pear, raspberry, strawberry, or grape juice may be substituted for the pineapple juice.

ALBUMIN WATER

1 egg white
½ cup cold water

Method. Clip the egg white with scissors or a silver knife and fork. Add water and strain through double cheesecloth. Be sure that all of the strings of albumin are removed. Pour carefully over crushed ice if patient objects to foam. The beverage may be flavored with a few drops of lemon juice if desired.

EGG WHITE AND MINT

1 egg white
2 teaspoons sugar
1 teaspoon lemon juice
Several sprigs fresh spearmint

Method. Whip egg white, add sugar and lemon juice. Crush lower parts of mint leaves slightly and place in glass. Pour mixture over ice in glass; stir well and serve at once.

Variations. Fill glass with carbonated water, Vichy, White Rock, Apollinaris, etc. This is especially good when patient suffers from nausea.

CREAM, EGG, AND VICHY

1 egg white
⅓ cup 35 per cent cream
Vichy to fill glass
2 teaspoons sugar
3–4 drops vanilla

Method. Whip egg white until stiff but not dry; whip cream and add sugar. Add vanilla, and fold in egg white. Pour over cracked ice and fill glass with Vichy.

ALBUMINIZED FRUITADES

⅓ cup orange juice
1 tablespoon lemon juice
1 tablespoon sugar
1 egg white
⅓ glass crushed ice

Method. Add sugar to fruit juices. Clip egg white with scissors or silver knife and fork, and add to fruit juice. Strain through double thickness of cheesecloth. Pour carefully over crushed ice and add water to fill glass. Stir with a fork instead of a spoon to avoid foam.

Any fruit juice such as grape, grapefruit, or pineapple may be used in place of the orange juice.

ALBUMINIZED LEMONADE

2 tablespoons lemon juice
1 tablespoon sugar
1 egg white
⅓ glass crushed ice

Method. Mix sugar and lemon juice with about one half cup water. Cut egg white with silver knife and fork or with scissors. Add to lemonade, and strain to remove shreds of egg white. Pour carefully over crushed ice and serve immediately.

EGG AND ORANGE

1 egg
1 tablespoon sugar
⅓ cup orange juice
2 tablespoons lemon juice
⅓ glass crushed ice

Method. Separate egg and beat yolk with sugar and fruit juices. Pour over crushed ice; add water and then stiffly beaten white of egg. If electric mixer is used, all ingredients may be placed in the container at the same time.

PINEAPPLE EGGNOG

1 egg
1 tablespoon sugar
$\frac{1}{3}$ cup pineapple juice
1 tablespoon lemon juice
$\frac{1}{3}$ cup 35 per cent cream

Method. Beat egg yolk and sugar together; add fruit juice. Fold in the stiffly beaten egg white and then the whipped cream. Pour over crushed ice.

HIGH CARBOHYDRATE LEMONADE

1 cup glucose
1 cup boiling water
$\frac{1}{4}$ cup lemon juice

Method. Dissolve glucose in boiling water. Cool, and add lemon juice. Add sufficient crushed ice to make two glasses (200 cc. each.)

Each glass of lemonade will contain approximately 100 grams of carbohydrate.

CHAPTER LIII

Breads

In the preparation of biscuits, muffins, and other quick breads it is well to keep certain points in mind. In making baking powder biscuits the dough should be soft but not sticky; use just enough flour to prevent dough from sticking on the board. Knead biscuit dough for about 30 seconds to make it smooth.

Stir muffin batter barely enough to mix the ingredients; do not beat it. Overmixing will cause muffins to be too compact, and tunnels will appear throughout the muffin. Muffin tins should be greased before filling and should be filled two thirds full. Muffins and biscuits require baking in a hot oven (425° F.). Muffins should be removed from the tins as soon as they are done. If allowed to stand in pans, muffins will steam and become unpalatable.

Flour should be sifted before measuring. Assemble all ingredients before starting the mixing process. Grease pans before mixing is begun.

PLAIN MUFFINS

(Six muffins)

1 cup flour
$\frac{1}{4}$ teaspoon salt
$1\frac{1}{2}$ teaspoons baking powder
1 tablespoon sugar
$\frac{1}{2}$ cup milk
2 tablespoons butter or other fat
$\frac{1}{2}$ egg

Method. Sift flour, salt, baking powder, and sugar together. Mix milk, melted butter, and egg. Pour into flour mixture stirring quickly and lightly. It is not necessary that the batter be smooth and free of lumps. Fill well greased muffin tins two thirds full and bake from 20 to 25 minutes in a hot oven (425° F.). When tins are very small, the temperature should be a little higher and the baking period shorter than that required for average-size muffins.

Variations. (1) Add one half cup raisins or nuts to dry ingredi-

nuts and proceed as above. If dates are used, cut in strips and add to milk which has been heated; allow to cool before adding egg. Then proceed as in original recipe. (2) *Wholewheat muffins.* Substitute three fourths cup unsifted wholewheat flour for one cup of white flour and proceed as in original recipe. (3) *Cornmeal muffins.* Substitute three fourths cup unsifted cornmeal (white or yellow) for one cup white flour and proceed as for plain muffins.

BRAN MUFFINS

(Twelve muffins)

¾ cup bran	¼ cup chopped dates or raisins
¾ cup flour	¼ cup chopped nuts
½ teaspoon soda	½ cup milk
1 teaspoon baking powder	½ egg
½ teaspoon salt	¼ cup molasses
1 tablespoon sugar	1 tablespoon melted butter

Method. Mix dry ingredients including fruit and nuts. Mix milk, egg, molasses, and melted butter. Add to dry ingredients, stirring as little as possible. Pour into greased muffin tins and bake in a hot oven ([illegible]° F.), allowing about 25 minutes or until muffins break away from the sides of the tin.

BAKING POWDER BISCUITS

(Four to six biscuits)

½ cup sifted flour	¾ teaspoon baking powder
¼ teaspoon salt	1 tablespoon shortening

2 to 3 tablespoons milk

Method. Measure sifted flour into cup with a spoon, add salt and baking powder, and sift into mixing bowl. Mix in shortening with tips of fingers or cut in with two knives. Stir in milk to make a soft but not sticky dough. Knead gently on lightly floured board for 20 to 30 seconds until dough is smooth. Roll out to a thickness of one half to three fourths of an inch and cut with small biscuit cutter. Place in lightly greased pan and bake in hot oven (450° F.) ten to twelve minutes, depending on thickness of biscuits.

Variations. (1) Use two tablespoons orange juice and one half teaspoon grated orange rind in place of the milk. (2) Add two tablespoons grated cheese to dry ingredients just before the milk is added.

BUTTERMILK BISCUITS*

(12 to 16 biscuits)

2 cups flour
½ teaspoon soda
¾ teaspoon salt
3 tablespoons fat
Buttermilk to make soft dough (approximately ¾ cup)

Method. Sift flour, soda, and salt together. Add the fat and cut or rub it into the flour. Add milk to make a soft dough, knead lightly, and roll half an inch thick. Cut out and bake in a hot oven (400° to 425° F.).

CORN BREAD*

(Serves 4 to 5)

1 cup buttermilk
1 teaspoon salt
1 egg
½ teaspoon soda
1 cup cornmeal
¼ cup flour
1 tablespoon melted fat

Method. Mix and bake in shallow pan or skillet in hot oven.

SPOON BREAD*

(Serves 3 to 4)

¾ cup cornmeal
1 teaspoon salt
3 tablespoons melted butter
1 cup water
1 cup milk
2 eggs
2 teaspoons baking powder

Method. Mix cornmeal, salt, and butter; add boiling water, beating until smooth. Add milk, well beaten eggs, and baking powder. When well mixed, turn into a greased baking dish or pan and bake in moderate oven (350° F.) for 40 to 50 minutes.

TOAST, DRY OR BUTTERED

Method. Cut bread in one fourth to one half inch slices. To make it crisp throughout, toast in slow oven. A toaster may be used, or the toast may be made under a direct flame. Care must be taken to turn the bread before the surface becomes too dark. Well made toast is golden brown on both sides, and should be slightly mellow in the center. Bread should be cut into shapes desired before toasting.

*Courtesy of Sally F. Hill, Editor, Home Department, *The Progressive Farmer*.

MELBA TOAST

Method. Cut bread in thin slices and place in a very slow oven, the temperature not to exceed 250° F. Dry out and allow to become yellow. The toast should be thoroughly crisp and brittle. Melba toast may be made in sufficient amounts to be served for several days. Crisp in oven before serving.

CINNAMON TOAST

1 slice bread
1 teaspoon butter
2 teaspoons granulated sugar
$\frac{1}{4}$ teaspoon cinnamon

Method. Cut bread in slices from one fourth to one third of an inch thick. Remove crusts and cut into desired shapes. Toast one side, turn over, butter lightly, and spread with a mixture of the cinnamon and sugar. Return to oven and allow to heat until mixture blends lightly with the bread.

CROUTONS

Method. Cut bread in slices one half inch thick and then into half inch cubes. Place in pan in oven and allow to toast, stirring occasionally to brown cubes on all sides. Remove from stove and dot with a small amount of butter if desired. Return to oven and stir to spread butter over all. Croutons are served with soup or in cream soups as a garnish.

CROUSTADES

Method. Cut $2\frac{1}{2}$ inch slice of bread. Trim off crusts and with a sharp knife cut out enough bread from center to form a box. Brush with butter and toast in moderately hot oven until brown.

MILK TOAST

1 slice bread
1 teaspoon butter
$\frac{1}{2}$ cup hot milk
Few grains salt

Method. Toast the bread on both sides and butter it; place in a deep plate and pour the hot milk over it.

CREAM TOAST

1 teaspoon flour
1 teaspoon butter
$\frac{1}{4}$ cup thin cream
1 slice bread

Method. Blend butter and flour together in double boiler and add cream. Stir until the mixture begins to thicken, cover, and allow to cook for fifteen minutes. Slice the bread and cut into cubes. Toast to a delicate brown and cover with cream sauce.

CHAPTER LIV

Cereals

Cereal grains furnish a large part of the energy needs of the body. Their extensive cultivation, their concentrated carbohydrate content, as well as their keeping properties, make them one of the staple foods for the human family. The widespread distribution of cereal grains and the ease with which they are transported make them the most economical foods in the diet, so much so, that in very low cost dietaries they furnish 30 to 40 per cent of the required calories. They are prepared as: (1) cereal waters, (2) cereal gruels, (3) breakfast cereals, (4) in combination with protein foods as eggs and cheese, and (5) breads and breadstuffs.

CEREAL WATER WITH FLOUR

2 tablespoons barley, rice, or oat flour	1 quart water
	$\frac{1}{2}$ teaspoon salt

Method. Mix flour with part of the water to make a thin paste. Place in top of double boiler; add rest of boiling water to flour mixture and stir for two or three minutes. Cover and cook for one hour, stirring occasionally. Add salt.

CEREAL WATER WITH CEREALS

2 cups boiling water	2 to 4 tablespoons cereal
$\frac{1}{2}$ teaspoon salt	

Method. Cream of wheat, farina, rolled oats, rice, wheat flakes, or other cereals may be used. Add salt to boiling water and sprinkle in the cereal. Cook 20 to 30 minutes, stirring occasionally. When quick cooked cereals are used, follow directions on the carton. At end of cooking time replace the water lost through evaporation to bring the amount back to the original two cups. Serve very hot.

CEREAL GRUEL

1 tablespoon flour
½ cup boiling water
½ cup hot water or milk
⅛ teaspoon salt

Method. Barley or rice flour, or oatmeal or cornmeal may be used. Mix cereal flour or meal with enough cold water to make a smooth paste. Place in top of double boiler, add boiling water, and stir constantly two or three minutes until it begins to thicken. Add hot milk or hot water and salt, and cook one hour.

GENERAL RULE FOR BREAKFAST CEREALS

Type of Cereal	Amount of Cereal Tablespoons	Liquid Cups	Salt Teaspoons	Time for Cooking
Oatmeal	4	1	¼	1 to 2 hours
Cornmeal	2½	1	¼	1 to 2 hours
Wheatena	4	1	¼	½ to 1 hour
Fine cereals	3	1	¼	½ to 1 hour

Method. Heat water to boiling point, add salt, and sprinkle in the dry cereal. Cook for five minutes over direct heat, stirring from time to time. Place over hot water and continue cooking for the required length of time.

Variation. Milk may be used for part or all of the water in the preparation of any of the above cereals.

Quick cooking cereals require a very short cooking time. The directions which are given on the cartons should be used for these cereals.

BOILED RICE

1 quart boiling water
½ teaspoon salt
3 tablespoons rice

Method. Wash rice thoroughly under running water to remove powder. Add salt to boiling water, and allow to boil briskly before adding the rice. Boil rice for about 20 to 30 minutes or until tender. Empty rice into a colander. Pour hot water over rice until each grain is separate and distinct. Shake the colander and place over a saucepan of hot water, taking care that the bottom of the colander does not touch the water. Place cover loosely over top of

colander, allowing space for steam to pass through. Serve rice hot with butter, or as a breakfast cereal with milk, sugar, and cinnamon, as desired.

STEAMED RICE

3 tablespoons rice
1 cup boiling water
¼ teaspoon salt

Method. Wash rice thoroughly. Boil water in top part of double boiler over direct flame. Add salt and rice, and boil for two to three minutes. Place in double boiler over hot water, cover, and cook until the rice has absorbed all the water. If not entirely tender when the water has been absorbed, add additional boiling water and continue the cooking. Avoid adding too much water at a time or the rice grains will not stay separate. When rice is tender lift top saucepan out of hot water and place for a few minutes over low flame to dry out.

CHAPTER LV

Cheese

Cheese is one of the foods mentioned by the earliest writers; it has been used in various forms by almost all peoples. All cheese is made from milk and contains less waste material than almost any other of the protein foods. Cheese represents the solid part or curd of milk. It is a concentrated form of protein of high biological value. Cheese dishes may be used for luncheon or supper instead of meat. They should be cooked at a low temperature since the protein is readily toughened.

CHEESE SOUFFLÉ

1 tablespoon butter	1/3 cup milk
1 tablespoon flour	1/3 cup grated cheese
1/8 teaspoon salt	1 egg

Method. Melt butter in top of double boiler over water. Add flour and salt and mix to a smooth paste. Add milk, stirring constantly until thick. Mix cheese with white sauce and cook until melted. Remove from hot water and stir in unbeaten yolk of egg. Beat white until stiff, but not dry, and fold into mixture. Pour into buttered baking dish and bake for about 45 minutes in a moderate oven. If baking dish is set in a pan of hot water during the baking period, overcooking is more readily avoided. Test by inserting tip of knife into center; if none adheres to knife, cooking is complete. Soufflé must be served immediately.

CHEESE FONDUE

1/3 cup milk	1 teaspoon butter
1/3 cup soft bread crumbs	1/8 teaspoon salt
1/3 cup American cheese cut into cubes	Pepper
	1 egg

Method. Scald milk in top of double boiler; add bread crumbs, cheese, butter, and seasoning. Remove from stove and add unbeaten egg yolk. Whip egg white stiff and fold into the mixture. Pour into a buttered baking dish, set in a pan of hot water, and bake in a slow oven (325° F.) for 30 to 40 minutes or until firm in center. Serve hot.

CREAMY CHEESE ON TOAST

½ cup milk	⅛ teaspoon salt
1 tablespoon flour	Pepper
⅓ cup grated cheese	1 slice bread

Method. Scald milk in double boiler; mix flour with a little cold water and stir into the hot milk. Add grated cheese and cook until mixture is of the consistency of medium thick white sauce. Toast bread, butter, and cut into cubes. Pour cheese sauce over toast cubes.

MACARONI AND CHEESE

¼ cup uncooked macaroni	¼ cup grated cheese
½ cup medium white sauce (page 644)	1 tablespoon bread crumbs

Method. Cook macaroni for about 20 minutes in boiling salted water. Drain and wash with hot water. Prepare white sauce and add grated cheese, stirring until cheese is melted. Combine macaroni with cheese sauce. Put into buttered baking dish, sprinkle with bread crumbs, and bake in a slow oven until brown — about 15 minutes.

RAREBIT

⅛ teaspoon mustard
¾ cup grated cheese
¼ cup medium white sauce (page 644)

Method. Add mustard and grated cheese to white sauce. Cook over hot water until cheese is melted. Serve immediately on toast or crackers.

BAKED RICE AND CHEESE

½ cup medium white sauce
¼ cup grated cheese
½ cup boiled rice

Method. Prepare white sauce as directed on page 644. Add grated cheese and stir until cheese is melted. Combine with rice, and turn into buttered baking dish. Bake for 15 minutes in a slow oven (325° F.).

CHAPTER LVI

Desserts and Dessert Sauces

There are various interpretations of the word "dessert." In most countries it represents the final sweet at the end of the meal: pudding, pastry, or similar prepared dishes. In England the term "dessert" means the fruit, nuts, raisins, and wine served after the pudding when the table has been cleared.

EGG AND MILK DESSERTS

SOFT CUSTARD

1 egg or 2 egg yolks	1 cup scalded milk
1 tablespoon sugar	3 to 4 drops vanilla

Few grains salt

Method. Beat egg and sugar together. Scald milk in top of double boiler and pour gradually over egg mixture. Return to double boiler and stir constantly until custard begins to thicken, then occasionally until it forms a coating on the spoon. Care must be taken to keep water in the lower part of the double boiler under the boiling point, because custard will curdle if the egg is cooked at too high a temperature. Add vanilla and salt when slightly cooled.

FLOATING ISLAND

1 egg white	2 tablespoons powdered sugar
Few grains salt	3 to 4 drops vanilla

Soft custard

Method. Whip egg white until stiff but not dry. Fold in salt, sugar, and vanilla. Pour custard into serving dishes and chill. When ready to serve garnish with meringue. The meringue may be browned slightly in an oven, if desired.

BAKED CUSTARD
(Two small custards)

1 egg
1 tablespoon sugar
Few grains salt
$\frac{3}{4}$ cup milk
Few drops vanilla
Few grains nutmeg

Method. Beat egg, sugar, and salt together. Stir in milk and vanilla, strain, and pour into custard cups. Sprinkle top lightly with nutmeg. Place cups in a deep baking pan and surround with hot water to about half the depth of the cup. Bake in a slow oven (325° F.) until a knife blade inserted into the center of the custard comes out clean — about 25 minutes. Care must be taken not to allow the water to boil because the egg proteins will separate, making a watery, unpalatable, and unattractive mixture. Serve either hot or cold, with or without whipped cream. If chilled before serving, custard may be turned out of cup into a fruit saucer or sherbet glass.

CARAMEL CUSTARD

Method. Caramel custard is made in exactly the same way as baked custard, except that the cup is lined with caramel made as follows: In a small frying pan put two tablespoons of sugar. Place over flame and stir constantly until the sugar melts and turns a golden brown. Fold a cloth over the custard cup and pour in the caramel, moving the cup about until the sides and bottom are well coated. Pour in the custard mixture and proceed as with baked custard.

PINEAPPLE OMELET

1 egg
2 tablespoons lemon juice
$\frac{1}{4}$ cup crushed pineapple
2 tablespoons sugar

Method. Beat egg yolk; add one tablespoon of the lemon juice, one tablespoon of the pineapple, and one tablespoon of the sugar. Beat white of egg until stiff, but not dry, and fold into the yolk mixture. Butter a smooth frying pan and heat. Pour omelet into hot pan and cook on top of stove until bottom of omelet is brown. Place in oven and bake until mixture will not adhere to the finger tips. During the baking process, heat all other remaining ingredients in small saucepan and, when ready to serve, pour over omelet.

JUNKET

$\frac{2}{3}$ cup milk
1 teaspoon sugar
Few drops of vanilla
1 tablespoon cold water
$\frac{1}{2}$ rennin tablet

Method. Heat milk to 100° F.; if milk thermometer is not available, test heated milk by allowing a drop of it to fall on inner side of wrist; if it is of the proper temperature, it will feel neither hot nor cold. Add sugar and vanilla. Dissolve rennin in cold water and stir into milk, stirring for a few seconds only. Pour into molds promptly and leave undisturbed until firm. Then place in refrigerator until needed.

STARCHY DESSERTS

BLANC MANGE

$1\frac{1}{2}$ tablespoons cornstarch
$\frac{1}{8}$ teaspoon salt
2 tablespoons sugar
1 cup milk
1 egg
$\frac{1}{4}$ teaspoon vanilla

Method. Make a paste of cornstarch, salt, sugar, and one fourth cup of milk. Scald remaining milk in top of double boiler and add to paste. Cook for 10 to 15 minutes, stirring constantly until mixture begins to thicken. Beat egg yolk and add cooked mixture gradually. Cook for about one minute more. Add vanilla and fold in beaten egg white. Pour into molds and serve with whipped cream.

Variations. (1) For chocolate blanc mange, add one half square chocolate to milk before scalding. (2) One half cup puréed banana and one teaspoon lemon juice may be added to pudding just before mixing with the egg yolk. (3) One half cup of cocoanut may be added to plain or chocolate blanc mange. (4) Plain blanc mange may be served with fruit sauce, fresh fruit, chocolate or butterscotch sauce.

SPONGE PUDDING

(Serves two)

$\frac{1}{4}$ cup flour
2 tablespoons sugar
1 cup milk
2 tablespoons butter
2 eggs
$\frac{1}{4}$ teaspoon vanilla

Method. Sift flour and sugar together and make into a thin paste with part of the milk. Heat the remainder of the milk and stir into the flour paste. When the mixture is thick and smooth, add the butter. Mix gradually with the beaten yolks and finally fold in the well beaten whites. The mixture is now turned into a baking dish and set in a pan of hot water. Bake in a slow oven until the custard is puffed up and brown. Serve with foamy sauce.

TAPIOCA CREAM

(Serves two)

1 tablespoon tapioca
1 cup milk
1 egg
2 tablespoons sugar
$\frac{1}{4}$ teaspoon vanilla

Method. Cook tapioca and milk in double boiler until tapioca is transparent. Beat egg yolk and sugar together. Add milk mixture to egg yolk and return to double boiler. Cook until thickened, stirring frequently. Cool slightly, add vanilla, and fold in stiffly beaten egg white. Chill and serve with whipped cream.

BAKED TAPIOCA

(Serves two)

3 tablespoons sugar
2 egg yolks
1 cup milk
2 tablespoons minute tapioca
6 dates

Method. Beat sugar and egg together, stir into the scalded milk, and mix with the tapioca and dates cut into small pieces. Pour mixture into custard cups, set in a pan of hot water, and bake in a moderate oven until the tapioca is clear and the custard is fairly firm in the center. The dates may be omitted if desired.

BAKED RICE PUDDING

(Serves two)

$1\frac{1}{2}$ tablespoons rice
2 cups milk
2 tablespoons sugar
$\frac{1}{4}$ teaspoon salt
$\frac{1}{4}$ teaspoon nutmeg or cinnamon

Method. Wash rice thoroughly in cold water; add milk and other ingredients. Place in a buttered pan and bake in a slow oven

for two hours, stirring from time to time as a scum forms on top of the milk.

ORANGE RICE CUSTARD

(Serves two)

2 egg yolks or 1 whole egg
2 tablespoons sugar
$\frac{1}{4}$ cup orange juice
$\frac{1}{2}$ cup milk
$\frac{1}{2}$ cup boiled rice

Method. Beat egg, sugar, and orange juice together. Mix milk and rice and combine the two mixtures. Pour into custard cups and set in a pan of hot water. Bake in a moderate oven (350° F.) for about 40 minutes or until custard is firm in the center.

RICE PUDDING

(Serves four)

1 egg
3 tablespoons sugar
1 cup milk
$\frac{3}{4}$ cup cooked rice
$\frac{1}{4}$ cup raisins
$\frac{1}{4}$ teaspoon salt
$\frac{1}{4}$ teaspoon vanilla

Method. Beat egg and sugar together and stir into milk. Add rice, raisins, salt, and vanilla and bake in individual custard cups which are set in a pan of hot water. About 40 minutes baking is required in a moderate oven (350° F.) until the custard is firm in the center. Chill and serve with plain or whipped cream.

APPLE BETTY

1 slice toasted bread
$\frac{1}{2}$ cup thinly sliced apple
3 tablespoons brown sugar
$\frac{1}{4}$ teaspoon cinnamon
$1\frac{1}{2}$ teaspoons butter

Method. Cover bottom of a small greased baking dish with small pieces of toasted bread, arrange half of apple slices over bread, sprinkle with half of sugar, and add a little cinnamon. Dot layer with butter and top with another layer of toast, apple, sugar, cinnamon, and butter. Bake for about 20 minutes in a moderate oven. Serve hot with hard sauce or cream.

Variations. (1) Cover apple betty before baking with one half cup of a custard mixture and bake in a pan of hot water at 350° F. (2) Any fruit may be used instead of apples.

GINGER PUDDING

(Serves four to six)

1 egg
½ cup sugar
¼ cup butter
1 teaspoon cinnamon
1 teaspoon ginger
½ cup molasses
½ cup hot water
2 cups sifted flour
1 teaspoon soda
½ teaspoon salt
½ teaspoon allspice

Method. Beat egg, sugar, and molasses together until light. Melt butter in hot water and add to egg mixture. Sift soda, salt, and spices with flour and add to wet ingredients. Beat well, pour into buttered 8 inch pan and bake in a moderate oven (350° F.) for about 20 minutes. Serve hot with lemon sauce or applesauce.

GELATIN DESSERTS

Preparation of Gelatin. Use granulated or flaked gelatin which is unflavored and unsweetened. Allow one level tablespoon of gelatin to one pint of liquid. Soak gelatin for five minutes in a small quantity of the cold liquid in order to swell the granules. Heat the remaining liquid and dissolve the gelatin in it.

To Mold Jelly. Large or individual molds may be used. Rinse molds in cold water and leave wet. Pour gelatin mixture into molds and set in cold place to congeal — about two to four hours for large molds. When jelly is congealed, set mold for half a minute in a pan of warm water. Loosen the jelly by inserting the point of a knife around edge. Invert mold over center of dish.

LEMON JELLY

(Serves two)

1½ teaspoons granulated gelatin
2 tablespoons cold water
1 cup boiling water
¼ cup sugar
¼ cup lemon juice

Method. Soak gelatin for five minutes in cold water and dissolve in boiling water. Add sugar and lemon juice to gelatin mixture. Strain into wet molds and allow to cool before placing in refrigerator to congeal. Serve with plain or whipped cream, or custard sauce.

ORANGE JELLY

(Serves two)

1½ teaspoons granulated gelatin
2 tablespoons cold water
¼ cup boiling water
3 tablespoons sugar
½ cup orange juice
2 tablespoons lemon juice
2 drops orange extract or ½ teaspoon grated orange rind

Method. Proceed as directed for lemon jelly.

GRAPE JUICE JELLY

(Serves two)

1½ teaspoons granulated gelatin
2 tablespoons cold water
¼ cup boiling water
¼ cup sugar
½ cup grape juice
1 tablespoon lemon juice

Method. Proceed as for lemon jelly.

WINE JELLY

(One to two servings)

1 teaspoon granulated gelatin
2 tablespoons cold water
½ cup boiling water
Grated rind of ¼ lemon
1 inch piece cinnamon
3 tablespoons sugar
1 teaspoon lemon juice
3 tablespoons sherry wine

Method. Soak gelatin in cold water. Boil water, lemon rind, cinnamon, and sugar for five minutes, and pour over gelatin. Add lemon juice and wine. If jelly looks cloudy, return to saucepan and add half an egg white which has been beaten stiff. Allow to boil one minute, stirring constantly. Strain into mold and chill. When firm, serve with whipped cream.

SNOW PUDDING

(Serves two)

Lemon jelly
1 egg white

Method. Prepare lemon jelly (page 607) and place the bowl in a pan of cracked ice. When the mixture begins to stiffen, fold in well beaten white of egg, beating it in with a rotary beater until the mixture is stiff. Pour the mixture into a mold or individual glasses and set in refrigerator to congeal. Unmold and serve with soft custard.

Orange or grape juice jelly may also be used in the preparation of this pudding.

ORANGE CHARLOTTE

(Serves two)

½ cup orange jelly	½ cup whipped cream

Method. Prepare orange jelly (page 608) and pour it into a bowl surrounded with cracked ice. When it begins to stiffen, whip well and fold in the stiffly beaten cream. Pour into molds or ice cream glasses and set in refrigerator to congeal.

PINEAPPLE CHARLOTTE

(Serves two)

1½ teaspoons granulated gelatin	1 tablespoon sugar
2 tablespoons cold water	1 tablespoon lemon juice
½ cup pineapple juice	¼ cup crushed pineapple

¼ cup whipped cream

Method. Prepare gelatin mixture as directed for lemon jelly (page 607). When mixture begins to stiffen, add crushed pineapple and fold in the whipped cream. Pour into molds and allow to set. Beaten egg white may be substituted for cream if desired.

SPANISH CREAM

(Serves two to three)

1 teaspoon granulated gelatin	1 egg
2 tablespoons cold milk	2 tablespoons sugar
⅔ cup scalded milk	Few grains salt

¼ teaspoon vanilla

Method. Soak gelatin for five minutes in cold milk and dissolve in scalded milk. Beat egg yolk slightly, add sugar, and salt. Stir milk mixture into egg and cook in double boiler until slightly thickened. Remove top of double boiler from stove and place in cold water until the mixture is of the consistency of unbeaten egg white. Add vanilla. Beat egg white until stiff with rotary beater and fold into custard. Pour into individual molds and chill. Serve with whipped cream, if desired.

RICE BAVARIAN CREAM

(Serves two to three)

2 teaspoons granulated gelatin
$\frac{1}{4}$ cup cold water
$\frac{1}{2}$ cup milk
3 tablespoons brown sugar
$\frac{2}{3}$ cup boiled rice
Few grains salt
$\frac{1}{2}$ teaspoon vanilla
$\frac{1}{3}$ cup 35 per cent cream

Method. Soak gelatin in cold water for five minutes. Heat milk in top of double boiler to scalding point and stir in gelatin until it is dissolved. Mix sugar, rice, and salt together, add to gelatin mixture, and add vanilla. Whip cream and fold into the rice-gelatin mixture as soon as the latter has cooled somewhat. Mold and serve with additional whipped cream, fruit sauce, or fresh fruit.

FRUIT WHIPS

GENERAL RULE FOR FRUIT WHIPS

4 tablespoons fruit pulp
2 tablespoons powdered sugar
2 tablespoons lemon juice
1 egg white

Method. Cook apple, apricots, or prunes in a small amount of water until tender. Press through sieve and measure four tablespoons for each serving. Add sugar and lemon juice. Whip egg white until stiff, but not dry, and fold into the fruit pulp. Serve with a soft custard sauce or with cream.

Fresh fruit as strawberries or peaches can be mashed and sieved. Lemon juice is not necessary for fresh fruit whips.

PRUNE FIG WHIP

(Serves two)

4 prunes
1 fig
2 tablespoons sugar
1 egg white

Method. Cook the prunes and fig in sufficient water to cover; press through sieve, add sugar, chill thoroughly, and fold in the stiffly beaten egg white. The above mixture may be put in individual cups and baked in a slow oven until it is firm in the center and a light brown. The cups should be set in a pan of hot water so that too rapid baking may be avoided. Serve with whipped cream or custard sauce.

FROZEN DESSERTS

The nurse is seldom required to prepare ice cream for her patient since it is so readily available in even the smallest communities. Any standard cookbook will give a variety of recipes should the need for them arise.

Desserts frozen in a refrigerator are palatable and easily prepared. They do not have the fine grain, however, of churned ice cream. To obtain a fine texture it is advisable to use some thickening agent such as eggs, cornstarch, flour, or gelatin.

FROZEN VANILLA CUSTARD

(Serves three)

1 cup soft custard (page 602)
½ cup 35 per cent cream

Method. Whip cream until stiff and fold into custard. Pour into tray and freeze in the freezing unit of refrigerator. When custard begins to harden, scrape from pan and beat well. Return to tray and allow to remain in freezing unit until frozen. About two to four hours is required for freezing.

Serve plain or with chocolate, butterscotch, or fruit sauce.

CHOCOLATE ICE CREAM

1 cup soft custard (page 602)
1 square chocolate
½ cup 35 per cent cream

Method. Melt chocolate with milk before preparing the soft custard. Whip cream and proceed as directed for vanilla custard.

CAKES AND COOKIES

Only very rarely is the nurse required to use her time in the preparation of cakes and cookies. Any standard cookbook will give a great variety of such recipes. The following are given here since they are easily prepared.

STANDARD RULE FOR PLAIN CAKE

½ cup butter or other fat
1 cup sugar
2 eggs
¼ teaspoon salt
1 teaspoon vanilla
⅔ cup milk
2½ teaspoons baking powder
1¾ cup cake flour

Method. Cream fat and sugar together until fluffy. Add well beaten egg yolks and beat. Mix salt, vanilla, and milk together. Sift flour, measure, and sift again with baking powder. Add liquid and flour alternately to egg mixture. Beat until smooth. Fold in egg whites which have been beaten until stiff but not dry. Pour batter into greased muffin tins or into an eight inch cake pan. Bake 20 to 30 minutes in a moderate oven (350° F.). This recipe will make about 16 cup cakes.

Variations. (1) Add from one to two squares chocolate which have been melted, before folding in the egg whites. (2) Add one half teaspoon cinnamon, one quarter teaspoon nutmeg, and one quarter teaspoon cloves to flour before it is mixed with egg mixture.

OATMEAL COOKIES

½ cup butter or other fat
½ cup sugar
1 egg
2 tablespoons milk
1 cup oatmeal
1 cup flour
½ teaspoon baking powder
¼ teaspoon soda
⅛ teaspoon salt
½ teaspoon cinnamon
½ cup raisins
½ cup chopped dates
½ cup chopped nuts

Method. Cream butter and sugar together and add beaten egg. Mix flour, oatmeal, soda, baking powder, spices, fruit, and nuts together and add to sugar-egg mixture using just enough milk to make a stiff batter. Drop by spoonfuls on well greased cookie sheet and bake in a moderate oven (350° F.).

SWEET SAUCES

COCOA SYRUP

(About one pint)

2 cups sugar
2 cups cocoa
3 cups water

Method. Mix sugar and cocoa. Stir into boiling water and cook gently until of a creamy consistency. Pour into jar, cool, cover, and place in refrigerator. In making cocoa from the above paste, allow one tablespoon of paste to each cup of hot milk.

BUTTERSCOTCH SAUCE

(About 1¼ cups)

¾ cup brown sugar
½ cup light corn syrup
¼ cup water
3 tablespoons butter
½ cup coffee cream
Few grains salt
¼ to ½ teaspoon vanilla

Method. Place sugar, corn syrup, water, and butter in saucepan over a low flame and stir until sugar is dissolved. Boil until a very soft ball will form when dropped in cold water (230° F. with a candy thermometer). Remove from stove, add cream, salt, and vanilla. Stir well and serve hot as a sauce for ice cream or over cup cakes.

FOAMY SAUCE

(About one half cup)

¼ cup butter
½ cup powdered sugar
½ egg yolk
1 tablespoon hot milk
¼ teaspoon vanilla
1 tablespoon sherry wine
1 egg white

Method. Cream butter and sugar, and stir in well beaten yolk, milk, and vanilla. Add sherry and pour into saucepan over hot water. Stir until thick and creamy, lift from hot water, cool as quickly as possible, fold in the stiffly beaten white of egg, and serve over pudding at once.

HARD SAUCE

1 to 2 tablespoons butter
2 tablespoons powdered sugar
1 to 2 drops vanilla

Method. Cream butter and sugar together until there are no lumps or grains in mixture. Flavor with vanilla.

LEMON SAUCE

(One cup)

½ cup sugar
1 tablespoon cornstarch
1 cup boiling water
Juice of 1 lemon
Grated rind of lemon
1 tablespoon butter

Method. Mix sugar and cornstarch, stir in the boiling water gradually, and cook eight to ten minutes, stirring continuously. Then add the lemon juice, grated rind, and butter. Serve sauce hot on puddings or cup cakes.

WINE OR FRUIT SAUCE

(About one half cup)

1 egg
$\frac{1}{3}$ cup powdered sugar
1 wine glass sherry wine or whisky

or

$\frac{1}{3}$ glass orange juice and 1 tablespoon lemon juice
1 teaspoon hot milk

Method. Beat yolk and white of egg separately. Add sugar to yolk and beat until creamy. Add wine or fruit juice, fold in egg white, and add the hot milk last. Serve at once.

CHAPTER LVII

Eggs

Eggs have a position in the invalid dietary second only to that of milk. They are nutritious, easy to digest, and exceedingly palatable. Because eggs furnish so large a part of the invalid dietary, it is advisable that care be taken not only in their preparation but also in their selection. Only the freshest eggs should be used. They should be cooked at a low temperature since their proteins are easily toughened. Eggs should be served immediately after being prepared.

POACHED EGG

1 egg	1 pint water
1 teaspoon salt	

Method. Fill a small saucepan with water to a depth of $2\frac{1}{2}$ inches, and add salt. Allow water to come to the boiling point, then lower the flame to keep water at the simmering temperature. Break egg carefully into a saucer and slip it gently into the hot water; cover and allow to cook until white becomes opaque, of jelly-like consistency, and a thin white film forms over the yolk; this requires from three to five minutes. Never allow water to boil after inserting egg. If water is poured gently over the yolk while cooking, the pan need not be covered. Remove egg with a perforated spoon and serve on buttered toast.

CODDLED EGG

1 egg	1 pint water

Method. Wash egg; drop in boiling water to cover and remove pan from flame. Allow to stand covered for seven to eight minutes. If very soft egg is desired, allow to remain in water for three to six minutes. Serve immediately.

HARD COOKED EGG

1 egg
1 pint water

Method. Wash egg; drop in saucepan of cold water, and bring slowly to boil. Lower the flame so that water is kept at simmering temperature, and allow to cook for 30 minutes. Plunge into cold water to avoid discoloration of the yolk.

SCRAMBLED EGG

2 eggs
2 tablespoons milk, cream, or tomato juice
¼ teaspoon salt
1 teaspoon butter

Method. Beat eggs slightly, add liquid and salt. Heat butter slowly in frying pan, and pour eggs into hot pan. Cook over low flame and stir with spatula until creamy — about three minutes. Serve at once.

A double boiler may be used instead of the frying pan to insure cooking at a low temperature.

CREAMY EGG ON TOAST

¼ cup milk
1 teaspoon butter
1 egg
⅛ teaspoon salt
1 slice toast

Method. Heat milk with butter in double boiler to scalding temperature, stir in the beaten egg, and cook until mixture is of a creamy consistency. Season and serve on buttered toast.

PUFFY OMELET

1 egg
⅛ teaspoon salt
1 teaspoon butter
Few grains pepper
1 tablespoon water, milk, or tomato juice

Method. Separate yolk from white, beat yolk with liquid and salt. Whip white until stiff but not dry and fold into yolk mixture. Pour into a hot lightly buttered pan and cook slowly on top of stove, lifting edge of omelet to determine when it has become brown. As

soon as brown, place pan in moderate oven and cook until the mixture will not adhere to the finger — about ten minutes. Place on warm plate, making a crease down middle of omelet, fold, and garnish with parsley. Jelly or chopped asparagus may also be used for a garnish.

Variations. (1) Add slice of crisply cooked and finely chopped bacon to top of omelet while baking.

(2) One tablespoon of grated cheese may be added to egg yolk before folding in the egg white, or may be sprinkled over omelet during the cooking process.

(3) When tomato juice is used, a tomato sauce may be poured over omelet at serving time.

FRENCH OMELET

1 egg
$\frac{1}{8}$ teaspoon salt
Few grains pepper
1 tablespoon water or milk
1 teaspoon butter

Method. Beat egg slightly; add salt, pepper, and liquid. Melt fat in small frying pan and grease the bottom and sides well. Pour in the egg mixture and cook slowly, pricking the mixture with a fork during the process to allow the uncooked portions on top to reach the pan. Avoid scrambling. When the entire mixture reaches a creamy consistency and is light brown on the bottom, fold and turn onto hot plate. A very smooth pan is necessary for making omelets.

EGG NEST

1 egg
2 teaspoons butter
Salt and pepper
1 slice toast

Method. Toast the bread on one side, spread untoasted side with part of butter, and place in pan. Beat white of egg until stiff and pile roughly upon the toast, leaving a slight depression in which the egg yolk is placed. Cook in moderate oven until the egg white is brown. Place the remaining butter on yolk, dust with salt and pepper, and serve at once.

EGGS A LA GOLDENROD

- $1\frac{1}{2}$ tablespoons flour
- $1\frac{1}{2}$ tablespoons butter
- $\frac{1}{2}$ cup milk
- $\frac{1}{4}$ teaspoon salt
- 1 hard cooked egg
- 1 slice toast

Method. Make white sauce with flour, butter, and milk; add salt. Separate white of the egg from yolk, chop white, and add to white sauce. Pour over the toast. Press the yolk through a strainer, covering the top of the toast. Garnish with parsley.

CHAPTER LVIII

Fruits

The attractive appearance, delicate flavor, and pleasing odor of fruits make an appeal to the appetite second to that of no other food. Fruits, like vegetables, have a high water content, contain carbohydrates in small to fairly appreciable amounts, and are low in fats. Avocados, or alligator pears, however, are rich in fat.

The mineral content of fruits gives them an outstanding value as body regulators, while the vitamins in some fruits — citrus fruits, for example — give them a noteworthy place in the dietary. Fruits, like vegetables, vary in their cellulose content. Raisins, dates, prunes, and other fruits whose skins are eaten lend bulk to the food mass in the intestinal tract and thus promote elimination of body waste.

BERRIES

Method. Remove undesirable berries and leaves. Place in sieve and wash berries under gently running water. Strawberries and other berries may be served with caps removed and sugar added just before serving. Specimen strawberries are sometimes offered with caps on, arranged on green leaves around a mound of powdered sugar, as a first course at luncheon. These large berries are eaten from the stem, which is held with the fingers.

FRUIT CUP

Method. A variety of fresh or canned fruit or a combination of both may be used for fruit cup. Sprinkle lemon juice on any raw fruits which discolor readily such as banana, apple, peach, and pear. Cut fruit in attractive pieces, mix, and chill before serving. A tablespoon of fruit juice, sweet cider, or wine may be added. Powdered sugar may be used for very tart fruits if desired. Garnish with a sprig of mint or fruit ice, if available.

The following are suggested combinations for fruit cup:

(1) Orange sections 4
Grapefruit sections 2
Fresh pineapple $\frac{1}{3}$ cup

(2) Equal parts of
Fresh or canned pineapple
Sweet cherries, pitted
Sliced banana sprinkled with lemon juice

(3) Equal parts of
Peaches
Pears
Pineapple

(4) Equal parts of
Oranges
Diced apples
Canned peaches
Tokay grapes

CANTALOUPE

Method. Cut melon in half, remove seeds, and fill with crushed ice. A potato-ball cutter may be used to cut fruit into balls, which are served on a mound of crushed ice.

Honeydew and Persian melons are served in the same way.

GRAPEFRUIT

Method. Select medium sized, thin-skinned fruit and cut along line midway between stem and bud ends. Run sharp, pointed knife around each section, separating the pulp from the skin and inner membrane. Remove center and seeds and serve without sugar unless the patient desires additional sweetening. Grapefruit, like oranges, may also be served in sections.

ORANGE SECTIONS

Method. Pare orange as an apple, using a sawing motion with the knife. Remove the white inner skin with the peel. Using a sharp, pointed knife, separate orange sections from the dividing membrane without breaking sections (see Fig. 40, page 539).

APPLESAUCE

1 apple
$\frac{1}{2}$ to 1 tablespoon sugar

Method. Wash and pare a tart apple. Cut into quarters and remove core. Add just enough water to keep the apple from scorching, cover, and cook slowly until apple mashes readily with a spoon — about 15 minutes. Add the sugar and beat well. The apple need not be peeled if the sauce is to be strained.

For serving at breakfast, no spices are added. Nutmeg, cinnamon, or lemon juice may be used for applesauce which is to be served as a dessert.

BAKED APPLE

1 apple
1 to 2 tablespoons sugar
1 teaspoon butter
$\frac{1}{4}$ cup water

Method. Wash and core the apple, place in small pan or baking dish, and fill cavity in apple with the sugar and butter. Add water and bake in moderate oven (375° F.) for about one half hour or until fruit can be readily pierced with a tooth pick. This may be a breakfast dish or a simple dessert. It may be served warm or cold, with or without cream.

STEAMED APPLES

Method. Baked apples burn rapidly and have a tendency to break unless particular care is given to them during the baking. If the apples are pared and cored and placed in a steamer for the first part of the cooking, this will not happen. When the apples are practically done, they are placed in a greased pan, sprinkled with sugar, and browned lightly under a direct flame.

CINNAMON APPLES

1 apple
1 cup water
1 tablespoon sugar
6 to 8 cinnamon drops

Method. Pare and core the apple, and place in a baking dish with water, sugar, and cinnamon drops. The last give the apple a pink color and a slight cinnamon flavor. When the fruit is tender, it is removed, and the remaining syrup is boiled down. When suf-

ficiently thick, it is poured over the apple. The fruit may be served for breakfast or as a dessert.

WHOLE BAKED BANANA

1 banana
1 teaspoon lemon juice

Method. Select fruit with green tinge on stem and slit skin lengthwise, opening sufficiently to sprinkle the surface with lemon juice. Bake until skin becomes dark and juices begin to exude from the fruit — 15 to 20 minutes. Lift out of skin before serving, dust with powdered sugar, and serve with or without cream.

STEWED DRIED FRUIT

4 to 6 prunes
or
4 to 6 apricot halves
or
3 peach halves

Sugar to taste

Method. Wash fruit carefully and soak for several hours or overnight. Simmer in the water in which it was soaked until the fruit is plump and tender — about 20 to 25 minutes. If the juice is too dilute, remove fruit and boil juice to desired thickness. Add sugar to taste, stir until dissolved and cool the fruit. Prunes usually do not require additional sugar, but a slice of lemon may be cooked with them.

Stewed fruit may be served alone or with whipped cream. It provides a welcome variation when served on breakfast cereal.

FIGS AND RAISINS

3 figs
12 raisins

2 teaspoons sugar

Method. Select whole dried figs and soak overnight. In the morning cover scantily with fresh water and cook until almost tender. Add raisins. Add sugar ten minutes before the fruit is ready to be taken from fire.

BAKED PEAR

1 pear
1 to 2 tablespoons sugar

Method. Medium size pears may be baked whole; larger pears bake better if cut in half. Remove skin but not the core and stand upright in a baking dish. Add sugar, and water to a depth of one fourth inch. Bake in moderate oven (350° F.) for 30 minutes or more until the pears can be pierced easily with a toothpick. Baste several times during the cooking process with the juice in the pan.

STEWED RHUBARB

1 cup rhubarb	$\frac{1}{2}$ to $\frac{2}{3}$ cup sugar

Method. Select tender, pink stalks of rhubarb, remove base of stalks and leaves and cut stalks into one half inch pieces. If rhubarb is old, peel stalks before cutting. Add sugar and cook slowly in covered saucepan until juice is extracted. Uncover and cook rapidly until tender — about 20 to 30 minutes.

CHAPTER LIX

Meat, Poultry, and Fish

The flesh of animals, poultry, and fish comes under the general heading of meat. In most instances meat is valued for its flavor and its staying properties, and in the majority of cases the menu is built around the meat. It contributes protein to the dietary as well as a variety of minerals, and vitamins of the B complex. Meat may be used in the diet of most invalids; there is very rarely an exception to this rule. Most meats are well digested and utilized, but pork, because of its high fat content, may not be tolerated by the very ill patient.

The nurse will usually not be asked to prepare any meats other than those which are quickly and easily cooked in individual portions, but she should be able to supervise the preparation of baked meats in larger quantities if the need arises.

SCRAPED BEEF

$\frac{1}{4}$ to $\frac{1}{2}$ pound round steak	1 teaspoon butter
Salt	

Method. Cut a piece of round steak into strips, place on the chopping board, and scrape with a silver spoon along the grain of the meat. This separates the muscle fibers from the connective tissue. Season scraped beef with a small amount of salt, and, with as little handling as possible, roll into balls the size of a walnut. Grease the bottom of a frying pan lightly with butter, heat, and place balls in pan, shaking over flame until they are seared on all sides. Serve on hot buttered toast.

Variations. After scraping meat, spread like butter on hot buttered or dry toast, season, and place under flame of broiler for a minute or so in order to sear the meat. Serve hot.

Chicken pulp from breast of chicken may be used in the same manner but requires somewhat longer cooking in the oven.

OVEN BROILED STEAK OR CHOPS

Method. Heat broiling oven for five to ten minutes and grease the broiler rack. Wipe meat with a damp cloth and place on rack about three inches below the flame. Cook until brown on one side, season with salt and pepper, and turn. Continue until the meat is seared on both sides, lower the rack, and cook for the required length of time. The table below gives approximate broiling time for various cuts of meat. Lift meat to a hot plate, place one teaspoon butter on it, dust the surface with salt and pepper, and serve hot. Parsley may be used as a garnish.

TIME TABLE FOR COOKING STEAKS AND CHOPS

Kind of meat	Cooking time minutes
Steak, $1\frac{1}{2}$ inches thick	8–15
Lamb chops, 1 inch	10–15
Lamb chops, $1\frac{1}{2}$ inch	18–20
Ham, $\frac{1}{4}$ inch	8–12
Ham, $\frac{1}{2}$ inch	15–20
Pork chop, 1 inch	25–30

PAN BROILED STEAK OR CHOPS

Method. Pan broiling is done on the top of the stove in a flat frying pan. Heat the pan until very hot; without greasing the pan, place the meat upon the hot surface. When one side of the meat has been seared, turn and sear the other side. Place pan on a cooler part of the stove or lower the flame to finish cooking. Season with butter, salt, and pepper. Garnish with parsley and serve hot.

ROAST MEAT

Method. Wipe meat with a damp cloth, season with salt and pepper, and place roast with fat side up in an uncovered dripping pan. Bake in a slow to medium oven (325° F.).

TIME TABLE FOR ROASTING MEAT

Kind of Meat	Internal Temperature Degrees F.	Time of Cooking Minutes per Pound
Ribs of beef—rare	140	21–25
medium	160	25–28
well done	170	30–35
Lamb, leg or rack	180	28–35
Veal	170	30–35
Pork	185	30–35

VEAL CUTLET

1 egg yolk
1 tablespoon water
¼ pound veal cutlet
3 tablespoons bread crumbs
1 tablespoon fat

Method. Mix egg yolk with water, dip cutlet first in egg and then in bread crumbs. Sauté in slightly greased frying pan or broil under the direct flame as for broiled meats. Serve plain or with tomato sauce (page 645).

BAKED HASH

⅓ cup diced cold meat
1 teaspoon minced onion
⅜ cup diced potatoes
2 teaspoons fat

Method. Mix meat, onion, and potatoes with enough water or milk to hold mixture together and spread over bottom of a hot frying pan liberally greased with fat. Cover pan and allow to cook without stirring until there is a crisp brown crust formed on the bottom. Fold as for an omelet and turn onto a hot platter. Hash may be baked in a moderate oven (375° F.) in a pie pan until brown.

Variation. Canned corned beef may be substituted for leftover meat.

VEGETABLES AND MEAT EN CASSEROLE

½ cup diced cooked meat
⅓ cup mixed vegetables
2 teaspoons flour
Gravy

Method. Carrots, potatoes, onions, celery, and turnips are suitable for the vegetable mixture. Place meat and vegetables in a deep baking dish, season with salt and pepper and sprinkle with flour.

Cover with leftover gravy or water in which a bouillon cube has been dissolved. If bouillon cube is used add one tablespoon fat. Cover dish and bake in a moderate oven (325° F.) for one hour or more.

MEAT PIE

Method. The mixture above may be made into a pie by arranging it in a wide baking dish and covering the top with a biscuit or shortcake dough (page 592) rolled half an inch thick. Place in hot oven until top of pie is brown and serve in the dish in which it is baked.

BROILED LIVER

1 slice liver ½ inch thick
Salt and pepper
1 teaspoon butter

Method. Remove membrane and veins from liver and wipe with a damp cloth. Preheat broiler for five to ten minutes and grease the broiler rack. Dot liver with butter or cover with a strip of bacon. Broil under direct flame for about five to eight minutes or until tender. Liver will be toughened if it is overcooked.

SAUTÉED LIVER

1 slice liver ½ inch thick
Flour
Salt and pepper

Method. Remove outer membrane and veins from liver and wipe with a damp cloth. Dredge with flour and cook in a well greased pan for six to seven minutes, turning frequently. Liver may be served with strips of bacon or with sautéed onions.

Calves' liver is very tender, but beef, lamb, or pig liver is equally nutritious and much less expensive.

LIVER LOAF

(Serves two)

½ pound beef liver
⅓ medium sized onion
⅓ cup cracker crumbs
1 tablespoon butter or fat
½ teaspoon salt
1 egg

Method. After soaking the liver in cold water, place in boiling salted water and cook until tender. Cool and grind with the onion in a food chopper. Brown the crumbs in butter or other fat, then mix with liver and onion. Add salt and egg. Form into loaf and bake until brown. Strips of bacon may be placed on top if desired. This loaf may be served hot or cold.

BROILED BACON

Method. Arrange bacon in a cold frying pan without crowding or overlapping and cook over a moderate flame until edges begin to curl. Turn each slice separately and remove before fat of bacon looks dry. Place in pan lined with absorbent paper to drain. Properly cooked bacon is crisp and readily broken with a fork; if underdone, it will be tough and have to be cut with a knife. When cooking a quantity of bacon, it is necessary to pour off the fat as it accumulates.

BACON BAKED IN OVEN

Method. When bacon is to be baked, arrange on rack above dripping pan in the oven and cook at temperature of 425° F., turning once during the process if necessary. The finished product is tender rather than tough and stringy, as is sometimes the case with bacon cooked on top of the stove.

PREPARATION OF SWEETBREADS

Method. Soak sweetbreads in cold water for 20 minutes and then put them in boiling water to which one tablespoon of vinegar and one half teaspoon of salt has been added. Boil gently for about 15 minutes or until tender. Drain, and place in cold water for 15 minutes. Remove skin. The sweetbreads are then ready for broiling, or use in creamed dishes.

BROILED SWEETBREADS

$\frac{1}{2}$ sweetbread
1 teaspoon butter
Salt and pepper

Method. Cook sweetbreads as directed above, brush with melted butter, and sprinkle with salt and pepper. Preheat broiler for five

minutes and place sweetbreads on hot greased rack. Broil for eight to ten minutes, turning from time to time.

SWEETBREADS WITH SPAGHETTI AND MUSHROOMS

1 tablespoon chopped mushrooms
½ tablespoon butter
½ tablespoon flour
¼ cup milk
½ boiled sweetbread, cubed
Salt and pepper
½ cup cooked spaghetti

Method. Sauté mushrooms in butter. Lift out mushrooms, add flour, and blend to a smooth paste. Stir in milk and cook to a creamy consistency. Add cubed sweetbreads and mushrooms to sauce. Season and serve over hot spaghetti.

BREADED LIVER
(Serves four)

1 pound liver
4 tablespoons lemon juice
½ teaspoon salt, pepper
2 eggs
1 cup bread crumbs
2 tablespoons fat

Method. Wipe and parboil liver gently for five minutes; drain and remove any loose membrane or skin. Add lemon juice and seasonings to slightly beaten eggs. Dip liver in egg; roll in crumbs and again in egg. Place in shallow pan containing hot fat and bake in oven (375° F.) for 25 minutes. Turn liver once during the baking.

Variation. When the liver has been browned, add enough tomato sauce (page 645) to cover, and cook until tender.

SWISS STEAK
(Serves six)

1½ pounds steak
Flour
Salt and pepper
3 tablespoons butter or fat
1 cup water
1 cup mushrooms or
1 cup stewed tomatoes

Method. Pound as much flour as possible into the meat, season, and sear surface of the steak in a hot skillet. Add one tablespoon butter and one cup of water in which mushrooms have been cooked;

cover and cook slowly until done. The steak may be served plain with gravy made in the pan or with mushrooms which have been chopped.

MEAT BALLS

(Serves four)

½ cup bread or cracker crumbs	1 egg
¼ teaspoon salt	½ pound ground lean beef
Pepper to season	4 slices bacon
⅛ teaspoon nutmeg	1½ cups tomato juice

Method. Mix one fourth cup of bread crumbs, salt, pepper, nutmeg, and slightly beaten egg with meat. Form in balls the size of a walnut and roll in remaining crumbs. Line pan with bacon, place balls on top, and pour tomato juice over all. Bake in moderate oven (350° F.) from 20 to 30 minutes. Serve on hot platter garnished with parsley.

POT ROAST

(Serves six)

2 to 2½ pounds medium fat beef (chuck, round, or brisket)	¾ cup sliced carrots
2 tablespoons flour	¾ cup sliced onion
2 tablespoons fat	¾ cup cut celery
½ cup water	1 teaspoon salt
¾ cup sliced turnips	½ teaspoon pepper
	1 cup canned tomatoes

Method. Wipe the meat with a damp cloth; roll meat in flour. Heat fat in heavy iron or cast aluminum kettle; brown the roast on all sides. Cook at a low temperature for three hours. Add water and vegetables, except tomatoes. Season with salt and pepper, cover closely, and cook until the vegetables are tender. Add tomatoes during the last half hour of cooking.

The above combination of vegetables is merely suggestive. Others may be used with equal success.

BEEF OR LAMB STEW WITH VEGETABLES

(Serves six)

1½ pounds beef or lamb	4 or 5 carrots, diced
4 cups water	1 teaspoon salt
3 onions, sliced	5 potatoes, diced

Method. Cut meat into one inch pieces and brown in frying pan. Add water, onion, carrots, and salt, and allow to simmer for one to two hours. Add potatoes and continue cooking until they are tender — about 30 minutes. The stew may be thickened if desired by adding two tablespoons flour mixed to a smooth paste with one fourth cup of cold water.

POULTRY

Poultry can usually be purchased dressed and drawn. If it has not been drawn the following directions may be helpful. Remove pin feathers, and singe off down by holding over direct heat until hair has disappeared. Cut head off at shoulders; loosen craw at base of neck and remove. Cut off oil sac and vent above tail and slit down the back, removing viscera, taking care to extract lungs, etc. Hold under running water and wash well. Clean and wash giblets.

BROILED CHICKEN

$\frac{1}{2}$ broiler ($\frac{3}{4}$ to 1 pound)
1 tablespoon butter
$\frac{1}{4}$ teaspoon salt
Parsley to garnish

Method. Clean chicken as described above. Preheat broiler for ten minutes. Lightly grease wire rack in broiler, place chicken on it, skin side down, and brown for about ten to fifteen minutes. Place two inches from flame in gas stove; place one inch below heat in electric stove. After browning one side, turn and allow the other to brown; lower flame and rub on one tablespoon butter, sprinkle with salt, and allow to cook a few minutes longer. Serve on hot platter garnished with parsley, sliced tomato, or toast points.

CREAMED CHICKEN

$\frac{1}{3}$ cup diced chicken
$\frac{1}{3}$ cup mushrooms
$\frac{1}{4}$ cup medium white sauce (page 644)
1 slice toast

Method. Mix chicken and mushrooms with hot cream sauce; serve on one slice of toast. Garnish with parsley.

Variations. Creamed chicken may also be served in the center

of a macaroni ring or ring of boiled rice, in croustades, pastry shells, or on waffles. Cold meat of turkey, fish, crab, lobster, or shrimp may be prepared by the same rule.

CHICKEN SOUFFLÉ

½ cup medium white sauce (page 644)	2 tablespoons bread crumbs
1 egg	½ cup chopped chicken
	¼ teaspoon salt

Method. Add beaten egg yolk, bread crumbs, chicken, and salt to the white sauce. Fold in stiffly beaten egg white. Pour into buttered baking dish. Set in a pan of hot water and bake in a slow oven (325° F.) for 15 to 20 minutes.

SOUTHERN FRIED CHICKEN

2 pounds chicken	Salt and pepper
Flour	Fat for frying

Method. Select fryers of not more than two pounds. Dress carefully and cut into attractive pieces. Roll in flour to which salt and pepper have been added. Drop into deep hot fat (375° F.) and fry until golden brown. Remove chicken and drain on unglazed paper. Serve hot or cold. Gravy may be made from part of the fat by adding flour and milk or water.

ROAST CHICKEN, CAPON, DUCK, TURKEY

Method. After dressing fowl carefully, fill cavity with a well seasoned bread dressing. Rub the skin with butter or, if bird is thin, place strips of bacon across the breast. Put on rack of covered or uncovered roaster, breast up, and bake in a moderate oven (350° F.), allowing shorter time per pound for large birds.

Chicken, Capon, or Duck		25 to 30 minutes per pound
Turkeys	7 pounds	3 hours
	12 pounds	3¾ hours
	18 pounds	5 hours
	22 pounds	5½ hours

When fowl is done, place on warm platter where it will remain hot. If dressing has dropped into pan and become burned, remove it carefully because it will give gravy a bitter taste.

To make gravy: pour off fat, leaving four to six tablespoons in roaster with which to blend two to four tablespoons flour. Scrape brown meat extractives from side of pan into the mixture and place roaster over direct heat. Stir in two cups of stock in which the giblets have been cooked. Allow to cook to desired thickness, add chopped giblets, season, and serve.

POULTRY DRESSING

3 tablespoons melted butter
2 tablespoons chopped onion
3 cups toasted bread cubes
1 cup diced apple
½ cup chopped celery
½ cup seedless raisins
1 teaspoon salt
¼ teaspoon pepper
1 teaspoon powdered sage
Milk

Method. Combine all ingredients except the milk. Scald sufficient milk to moisten dressing and pour over mixed ingredients. Stir lightly and pile loosely into cavity of fowl.

The above recipe provides sufficient stuffing for a four pound fowl.

OVEN BROILED FISH

Method. Wipe fish with a cloth after washing thoroughly. Preheat broiler for five to ten minutes. Grease broiler rack and place fish on it, skin side down. Cook for eight to twelve minutes or until brown and flaky. Serve with parsley butter sauce (page 645) or tartar sauce (page 646).

PAN BROILED FISH

Method. Wash fish and wipe with a cloth. Melt one tablespoon butter or fat in a frying pan. Dip fish in flour, season with salt and pepper, and sauté until brown on both sides.

CREAMED FISH

⅓ cup cooked or canned fish
½ hard boiled egg
¼ cup medium white sauce (page 644)
1 sliced buttered toast

Method. Flake the fish into small pieces and add with chopped egg white to the cream sauce; pour over the toast. Press the egg yolk through sieve over the fish and garnish with parsley or strips of pimento.

STUFFED CRAB

1 crab
2 tablespoons bread crumbs
2 teaspoons butter
$\frac{1}{4}$ teaspoon salt
$\frac{1}{8}$ teaspoon pepper

Method. Boil crab until done and lift from boiling water. Pick meat from shell of crab; mix with salt, pepper, and butter. Stuff into shell, cover with bread crumbs, and brown in oven.

BROILED LOBSTER

1 lobster
1 tablespoon butter or oil
$\frac{1}{4}$ teaspoon salt
$\frac{1}{8}$ teaspoon pepper

Method. Put live lobster into boiling water to cover and boil until lobster is bright red — about 20 to 30 minutes. Split lobster down back and carefully remove cord, gall sac, and sand bag. Brush with oil and broil under hot flame for about eight minutes on each side. Season with salt and pepper, and serve with melted butter.

OYSTERS AND BACON
(Pigs in Blanket)

4–6 medium size oysters
2–3 strips bacon

Method. Wrap oysters with a third strip of bacon, pin with tooth pick, arrange in dripping pan, and broil until bacon is crisp. If only small oysters are available, two may be wrapped together. The "pigs" may be cooked in a frying pan on top of the stove if desired, but require careful watching to prevent burning.

BAKED SALMON LOAF
(Serves six)

1 No. 1 can salmon
1 hard cooked egg
$\frac{1}{2}$ teaspoon salt
Few grains red pepper
1 tablespoon lemon juice
1 tablespoon chopped parsley
1 cup bread or cracker crumbs
$\frac{1}{2}$ cup milk
1 egg

Method. Drain fish and flake, removing bones and skin. Chop hard cooked egg into small pieces and add to fish. Season with salt,

pepper, lemon juice, and chopped parsley. Cook bread or cracker crumbs in milk for two or three minutes, reserving one fourth cup of crumbs to use on top and sides of loaf. Beat raw egg slightly and add to crumb mixture, folding all into fish lightly. Shape in loaf form and place in well greased pan or mold. Dust with crumbs, dot with butter, and bake in oven (350° F.) in pan of hot water for 30 to 40 minutes or until firm. Serve with white sauce or tomato sauce (page 645).

CHAPTER LX

Salads and Salad Dressings

Salads have been growing in popularity for years. Formerly this type of food was considered more or less of a luxury — a desirable but by no means essential part of the menu. Today salads are assuming a more and more important place in the dietary, providing the color, attractiveness, and balance which many of the staple foods lack. They are a valuable source of minerals and vitamins.

PREPARATION OF SALADS

Certain general rules should be observed in the preparation of all salads.

All greens, as lettuce, watercress, romaine, chicory, endive, and escarole, should be washed thoroughly and chilled. They may be placed in wax paper or a damp cloth and stored until ready for use.

Fruits and vegetables should be thoroughly drained before they are combined with other ingredients.

Fruits and vegetables should be cut in attractive pieces. Green pepper, pimento, and raw carrots should be finely shredded.

Precise architectural arrangements of food on salad greens should be avoided. The "candle" salad and wheel arrangements, for example, are not in good taste.

Salads should always be crisp and cold. This requires that all the ingredients be thoroughly chilled before making the salad, and that salad plates are also cold.

VEGETABLE SALADS

Vegetable salads may be served as the first course of a meal, as an accompaniment to the main course, or as a separate course following the main course.

MIXED GREEN SALAD

Method. Shredded lettuce and other greens may be combined with finely sliced radishes, cucumbers, or carrots and marinated for a few minutes with French Dressing.

SHREDDED CARROT AND CABBAGE SALAD

$\frac{1}{4}$ cup shredded cabbage
$\frac{1}{4}$ cup shredded carrots
French dressing
Salad greens

Method. Marinate cabbage and carrots with French dressing and serve on salad greens.

POINSETTIA SALAD

1 medium bright red tomato
1 teaspoon French dressing
1 teaspoon mayonnaise

Method. Turn tomato on a fork over flame until the skin blisters, taking care not to allow the tomato to cook. Remove skin with a sharp knife and place in refrigerator until thoroughly chilled. With point of knife cut five to seven petals beginning at the top of the tomato and cutting down within an inch of the stem end, slip knife between each point and the seed section, taking care not to cut or break off petal. Place on a bed of lettuce and gently press points down to resemble petals of a flower. Cut seed portion in four parts and press open, pour French dressing over the whole, and fill cavity with mayonnaise. Serve on lettuce.

STUFFED TOMATO

1 medium tomato
$\frac{1}{8}$ teaspoon salt
1 tablespoon diced cucumber
1 tablespoon diced celery
1 tablespoon chopped green pepper
2 teaspoons mayonnaise

Method. Remove skin from tomato by turning over flame until skin blisters. Cut slice from top and remove pulp, sprinkle inside with salt, and allow to drain. Fill cavity with mixture of cucumber, celery, green pepper, tomato pulp, and one teaspoon of the mayonnaise. Place on lettuce and garnish with thinly sliced rings of pepper and mayonnaise.

Variation. This recipe may be molded by mixing part of the following gelatin mixture with the stuffing and placing it in the tomato. The tomato is then placed in a mold and the rest of the gelatin is poured over it.

Gelatin mixture:
- 1 teaspoon gelatin soaked in
- 1 tablespoon cold water and dissolved in
- ¼ cup mild boiling vinegar

TOMATO JELLY

- 1½ teaspoons granulated gelatin
- 2 tablespoons cold water
- 1 cup canned tomatoes
- ½ cup diced celery
- 6 cloves
- 1 tablespoon minced parsley
- ½ teaspoon salt
- 1 bay leaf
- ¼ cup vinegar

Method. Soak gelatin in cold water. Boil remaining ingredients together for 20 minutes; press through a sieve, return to stove, and bring to a boil. Pour over the soaked gelatin and stir until gelatin is dissolved. Strain into wet molds.

POTATO SALAD

- ½ cup cold boiled potato, diced
- 2 tablespoons diced celery
- 1 tablespoon diced cucumber
- 1 tablespoon French dressing
- 1 tablespoon boiled dressing or mayonnaise
- Lettuce
- Radishes, parsley, or hard cooked egg

Method. Marinate potato, celery, and cucumber with French dressing. Before serving, mix with boiled dressing and place on lettuce. Garnish with radishes, parsley, or hard cooked egg.

CABBAGE AND APPLE SALAD

(Serves six)

- 1 cup diced apple
- 2 cups shredded cabbage
- ½ cup boiled dressing
- Salt

Method. Toss apple and cabbage together with dressing, using wooden fork or spoon. The addition of a shredded carrot improves the attractiveness of this salad.

COLESLAW

(Serves four)

1 slice bacon
1 tablespoon vinegar
2 cups shredded cabbage
$\frac{1}{2}$ cup celery, diced
1 tablespoon chopped onion
$\frac{1}{4}$ cup boiled dressing
Salt and pepper

Method. Cut bacon into small pieces and cook until crisp enough to mash with a fork, taking care not to allow any pieces to burn. Add the vinegar to bacon. Pour over cabbage, celery, and onion and mix lightly. Add salad dressing or mayonnaise.

Variation. This may be made into a hearty salad by the addition of a hard cooked egg.

FRUIT SALADS

Fruit salads may be served as an accompaniment to the main course of a lunch or dinner or as a dessert. When they are used at the end of a meal they are frequently combined with nuts, whipped cream, or marshmallows. They are sometimes frozen in the freezing tray of a refrigerator.

ORANGE AND GRAPEFRUIT SALAD

4 sections orange
3 sections grapefruit
Lettuce or watercress
French dressing

Method. Section fruit according to the method described on page 620. Arrange alternate sections of orange and grapefruit on salad greens and serve with French dressing.

WALDORF SALAD

$\frac{1}{3}$ cup apple
2 tablespoons English walnuts
2 tablespoons diced celery
2 teaspoons mayonnaise
Lettuce

Method. Select firm tart apples. Pare, core, and cut apple into half inch cubes. Break the walnuts into pieces. Mix the ingredients together and add mayonnaise. Place upon lettuce leaves or other salad greens.

COMBINATION FRUIT SALAD

1 slice canned pineapple
2 sections grapefruit
6 white grapes or cherries
Lettuce
Mayonnaise
1 orange cut in sections

Method. Dice pineapple, add shredded grapefruit, and grapes or cherries. Mix with mayonnaise. Arrange small inner leaves of lettuce on a salad plate. Pile mixture in center of lettuce. Arrange orange sections about the fruit mixture.

Variations. Jellied: Line mold with orange sections and then fill with other ingredients. Pour over all a gelatin mixture of one fourth tablespoon gelatin soaked in one tablespoon cold fruit juice and dissolved in one fourth cup boiling fruit juice. Pineapple juice from canned fruit may be used. Chill and serve, when jellied, with mayonnaise.

Frozen: Add one tablespoon mayonnaise and one tablespoon whipped cream to the fruit mixture. Pour into a small mold. Seal the edges of the mold with a strip of muslin dipped in melted butter. Pack the mold in ice and salt, allowing it to stand for two hours. The freezing may be accomplished in the refrigerator if desired.

SALADS WITH PROTEIN FOODS

Salads which contain a protein food as eggs, cheese, fish, or meat may be used as the main course for luncheon or dinner. The protein is usually combined with a vegetable or fruit to give taste appeal.

STUFFED EGG SALAD

1 hard cooked egg
1 teaspoon anchovy paste
Green pepper
Lettuce leaves
Mayonnaise

Method. Cut egg lengthwise. Mash yolk through sieve and add anchovy paste and a little mayonnaise. Return yolk paste to the white and arrange on slices of green pepper. Place on lettuce and serve with mayonnaise or any preferred salad dressing.

CHICKEN SALAD

$\frac{1}{3}$ cup diced chicken
$\frac{1}{3}$ cup diced celery
1 tablespoon French dressing
1 tablespoon chopped olives
2 tablespoons chopped almonds
$1\frac{1}{2}$ tablespoons mayonnaise
Lettuce

Method. Marinate chicken and celery with French dressing for an hour or more in refrigerator. Add olives, nuts, and mayonnaise. Season to taste, serve on lettuce.

COTTAGE CHEESE SALAD

$\frac{1}{3}$ cup cottage cheese
1 teaspoon minced green pepper
Salad greens
French dressing
Paprika

Method. Mix cottage cheese with minced green pepper and serve on lettuce or other salad greens with French dressing. Garnish with paprika.

Variations. The above cottage cheese mixture may be served with:

(1) Sliced pineapple, or halves of pear or peach
(2) Sliced tomato, or whole tomato stuffed with the mixture.

SHAMROCK SALAD

(Serves two)

1 green pepper
$\frac{1}{2}$ package ($1\frac{1}{2}$ ounces) cream cheese
2 teaspoons mayonnaise
$\frac{1}{4}$ cup chopped olives
Lettuce

Method. Rub cheese and mayonnaise together to a smooth paste, add olives (or nuts if desired), and pack into pepper shell from which the seeds have been removed. Chill throughly in refrigerator. When ready to serve, cut into thin slices and arrange in the form of a clover leaf on a bed of lettuce. Garnish with mayonnaise.

FISH SALAD

$\frac{1}{3}$ cup shrimp, flaked salmon, tuna, crabmeat, or lobster
$\frac{1}{3}$ cup diced celery
1 tablespoon French dressing
1 tablespoon mayonnaise
Lettuce
$\frac{1}{2}$ hard cooked egg
$\frac{1}{2}$ tomato

Method. Mix fish, celery, and French dressing. Chill for one hour and mix with mayonnaise. Serve on lettuce and garnish with slices of hard cooked egg and wedges of tomato.

Variation. A whole tomato from which the pulp has been removed may be stuffed with the above mixture.

BOILED DRESSING

(About 1½ cups)

2 tablespoons flour
1 tablespoon sugar
1 teaspoon salt
½ teaspoon dry mustard
¾ cup water or milk
¼ cup mild vinegar
1 egg
2 tablespoons butter or other fat
⅛ teaspoon red pepper

Method. Mix flour, sugar, and seasonings and slowly add milk which has been heated in a double boiler. Cook until thickened, stirring constantly. Add vinegar and blend well. Pour mixture over slightly beaten egg and cook for one to two minutes longer. Add butter and cool before using.

FRENCH DRESSING

(About 1¼ cups)

½ teaspoon salt
½ teaspoon paprika
⅛ teaspoon red pepper
1 to 2 teaspoons powdered sugar
¼ to ⅓ cup lemon juice or vinegar
1 cup salad oil

Method. Add dry ingredients to oil and lemon juice in jar. Cover closely and shake briskly until emulsified, or place in a deep bowl and beat well with a rotary beater. If the dressing is not to be used at once, shake well before serving.

Variations. (1) Add one and one half teaspoons onion juice and two and one half teaspoons Worcestershire sauce to one cup French dressing. (2) Add one finely chopped pimento, one half green pepper, and one green onion.

FRUIT JUICE DRESSING

(About 1½ cups)

1 egg
2 teaspoons cornstarch
¼ teaspoon salt
1 teaspoon sugar
1 cup fruit juice
2 tablespoons lemon juice

Method. Beat egg and add cornstarch, salt, and sugar. Add fruit juice and lemon juice and cook in double boiler until thick.

Variations. (1) Marshmallows may be cut and beaten in thoroughly if desired. (2) Whipped cream may be mixed with the cooled salad dressing.

MAYONNAISE DRESSING

(About 1½ cups)

1 egg yolk, or one whole egg
¼ teaspoon dry mustard
½ teaspoon salt
1½ tablespoons lemon juice or vinegar
1 cup salad oil

Method. Mix dry ingredients with egg. Add lemon juice and stir well. With a rotary beater begin to beat in oil a few drops at the time until the mixture begins to thicken; then add in larger quantities. Beat until stiff. If whole egg is used, increase salad oil to one and one half cups.

The emulsion may break because of too rapid addition of oil or incontinuous beating. If this occurs, beat an egg yolk in a clean bowl and add the broken emulsion drop by drop until completely added; then continue again with the above recipe.

Variations. (1) Add one half cup Roquefort cheese to one cup of mayonnaise. (2) Mix equal quantities of whipped cream and mayonnaise.

RUSSIAN DRESSING

(About 1½ cups)

2 tablespoons chopped green pepper
2 teaspoons Worcestershire sauce
2 teaspoons onion juice
2 tablespoons chili sauce
2 teaspoons minced parsley
1 cup French dressing or mayonnaise

Method. Add ingredients to French dressing or mayonnaise and allow to stand at least an hour. Mix well before using.

THOUSAND ISLAND DRESSING

(About 2½ cups)

½ cup chili sauce
2 tablespoons minced pickles or capers
½ cup minced green pepper
½ cup minced olives
1 hard cooked egg
1 cup mayonnaise

Method. Mix all ingredients except mayonnaise and drain off any surplus fluid. Fold mayonnaise into mixture lightly and serve over lettuce or other salad greens.

CHAPTER LXI

Sauces

White Sauce may be used in the preparation of vegetable milk soups and as sauce for vegetables, creamed meats, and toast. Thin and Very Thin White Sauce may be used with vegetable milk soups, while Medium White Sauce is suitable for creamed vegetables, fish, or meats. Thick White Sauce is used as a base for croquettes or soufflés. Special White Sauce, which contains a little onion, may be used with vegetables of little flavor, such as potatoes or Lima beans. Coffee cream may be substituted for half of the milk if a high caloric white sauce is desired.

WHITE SAUCE (VERY THIN)
(One cup)

½ tablespoon fat	1 cup milk
½ tablespoon flour	½ teaspoon salt

Method. Melt the fat in top of double boiler and mix in the salt and flour to make a smooth paste. Add milk gradually to the flour mixture and continue stirring until thickened sufficiently. Cover and cook for 10 to 15 minutes.

WHITE SAUCE (THIN)
(One cup)

1 tablespoon fat	½ teaspoon salt
1 tablespoon flour	1 cup milk

Method. Use method described above for Very Thin White Sauce.

WHITE SAUCE (MEDIUM)
(One cup)

2 tablespoons fat	½ teaspoon salt
2 tablespoons flour	1 cup milk

Method. Use method described for Very Thin White Sauce.

WHITE SAUCE (THICK)

(One cup)

3 tablespoons fat
3 tablespoons flour
½ teaspoon salt
1 cup milk

Method. Use method described for Very Thin White Sauce.

SPECIAL WHITE SAUCE

(One cup)

1 teaspoon chopped onion
1 stalk celery
2 tablespoons butter
1 to 3 teaspoons flour
½ teaspoon salt
1 cup milk

Method. Cook onion and celery with butter over low flame until slightly yellowed. Rub through sieve and return to saucepan; add flour and proceed as in making other white sauces.

CHEESE SAUCE

(One cup)

3 tablespoons grated American cheese
1 cup thin white sauce

Method. Heat white sauce over hot water, stir in grated cheese, and continue to stir until cheese is melted and completely incorporated. Edam or pineapple cheese may be substituted for the American cheese if desired.

TOMATO SAUCE

(Serves one)

1 teaspoon butter
½ teaspoon flour
¼ cup tomato juice
Salt

Method. Rub flour and butter together; heat tomato juice and add flour mixture. Stir until smooth and of the consistency of cream sauce.

PARSLEY BUTTER

1 teaspoon butter
½ teaspoon lemon juice, if desired
Salt and pepper
1 tablespoon chopped parsley

Method. Cream butter; add lemon juice, salt, and pepper. Stir in parsley. Serve on individual portion of fish or meat.

HOLLANDAISE SAUCE

(One half cup)

1 egg yolk
2 tablespoons lemon juice
Salt and pepper
1 tablespoon butter
¼ cup water

Method. Beat egg yolk with lemon juice, add one half of the butter, and place in double boiler over hot (not boiling) water. Stir until it begins to thicken and add remainder of butter; stir in boiling water and cook until consistency of boiled custard.

TARTAR SAUCE

(One third cup)

1 tablespoon chopped olives
1 tablespoon chopped pickle
⅓ cup mayonnaise
1 tablespoon chopped capers
1 tablespoon chopped parsley

Method. Mix chopped ingredients with mayonnaise.

CHAPTER LXII

Soups

Soups play a very important role in the dietary. Clear soups, broths, and meat extracts are low in nutrient value but are of definite value as stimuli to the secretory cells of the stomach. They may be made more nutritious by the addition of rice, barley, noodles, or tapioca. Meat extractives, which form the base of all soup stocks, are high in purines. It is to these extractives that meat soups and broths owe their flavor.

The nurse is seldom required to use her time in the preparation of clear soups, but she should be familiar with the methods for their cookery so that she can undertake to make them if necessary. There are many excellent canned soups. Bouillon cubes and various meat extracts when properly diluted with water are also good substitutes for home prepared broths.

Clear soup should be served in a heated cup. Croutons (page 594) may be placed in the soup at serving time, or Melba toast or crackers may be served on a separate plate.

BEEF OR LIVER JUICE

(About one ounce)

$\frac{1}{4}$ pound liver or lean beef

Method. Wipe meat with clean damp cloth and cut into one inch pieces. Lightly sear in a hot pan and place in a meat press to extract the juice. Season with salt and serve.

Searing is not necessary but generally improves the flavor. If the color of the juice is objectionable, it may be placed in a cup and set in hot water (about 155° F.). This heat will change the color to brown.

BEEF TEA
(One pint)

1 pound ground beef
½ teaspoon salt
1 pint water

Method. Place meat in top part of double boiler, cover with cold water, and set in cool place for one hour. Put top container over water, bring water in lower container to a temperature of 140° to 150° F., and maintain this temperature for two hours or more. Then gradually increase the heat to turn the beef to a chocolate color. Beef tea should never be allowed to boil. Strain, remove fat, add salt to season, reheat, and serve in cup.

BEEF BROTH
(One pint)

1 pound lean beef
1 quart water
½ teaspoon salt
Pepper to season

Method. Cut beef in small pieces, cover with cold water, and allow to stand for one to two hours. Add salt and gradually bring to boiling point. Simmer three hours, skim off the fat, and add pepper if desired.

To clear broth: Mix one lightly beaten egg white with two teaspoons water and add to stock. Boil for two minutes. Allow to settle for 20 minutes and then strain through a double thickness of cheesecloth.

CHICKEN BROTH
(One quart)

3 pounds chicken
2 quarts water
1 teaspoon salt

Method. Remove as much of the fat as possible, cut fowl into pieces, crack the leg bones, place in kettle, and cover with cold water. Allow this to stand for one to two hours, cover, bring slowly to the boiling point, and simmer three hours or more. Strain and remove fat. If possible, allow to cool to permit the fat to congeal in order to more readily remove it. Reheat, and remove remaining fat globules by brushing a paper napkin across the surface.

The boiled chicken may be used for salads, or creamed dishes.

CLAM OR OYSTER BROTH

(One pint)

1 dozen clams or oysters
1 pint water
or
1 cup milk and 1 cup water
1 tablespoon whipped cream
Pepper and salt to season

Method. Scrub clams, place in an iron skillet, and allow to heat gently until the shells open. When oysters are used, allow to heat until the edges curl. Chop, cover with hot water, and allow to simmer fifteen minutes; strain and add whipped cream and a dash of salt and pepper. If milk is to be used in place of part of the water, add it during the last five minutes of cooking. Clam broth without milk may be served hot or cold; unlike other broths it will not jell, but it may be frozen if desired.

CLAM BROTH

½ cup canned clam juice
½ cup water or milk
Salt and pepper to taste
1 tablespoon whipped cream

Method. Mix clam juice with water or milk, heat, and season with salt and pepper. Pour into cup, place whipped cream on top, and serve at once.

BROTH WITH EGG

1 egg
⅔ cup hot broth

Method. Beat egg slightly. Add broth gradually to the egg, stirring continuously in order to avoid overcooking the egg. Serve immediately.

TOMATO BOUILLON

½ cup tomato juice
Salt and pepper
⅔ cup broth

Method. Mix the ingredients and bring to the boiling point. Serve in a heated container.

BROWN SOUP STOCK

(About one quart)

2 pounds lean beef
½ teaspoon salt
⅛ teaspoon pepper
1 whole clove
1 large sprig parsley
1 teaspoon soup herbs
5 or more cups water
2 tablespoons mixed vegetables (carrots, celery, and onion)

Method. Cut the meat in small pieces and sear half of it in a hot frying pan until brown. Add the rest of the meat and the salt, pepper, clove, parsley, and herbs. Cover with cold water and allow to stand at least thirty minutes. Bring slowly to the boiling point, cover closely, and simmer gently for four hours or more, skimming several times while the stock is cooking. Add vegetables, and cook for another hour. Strain and cool rapidly.

VEGETABLE SOUP

- 1 cup meat stock
- $\frac{1}{4}$ cup mixed vegetables (carrots, celery, onion, potatoes, tomatoes)
- 1 teaspoon rice
- Salt and pepper to season
- Sprig of parsley

Method. Dice vegetables and cook with stock for one hour or until vegetables are very tender. Potatoes or tomatoes, if used, should be added about one half hour after the other vegetables. Season with salt and pepper. Garnish with chopped parsley.

CHICKEN JELLY
(One pint)

- $\frac{1}{2}$ small chicken
- 3 pints water
- $\frac{1}{2}$ cup celery
- 1 sprig parsley
- $\frac{1}{2}$ teaspoon salt
- $\frac{1}{4}$ teaspoon red pepper
- 1 tablespoon gelatin soaked in
- $\frac{1}{4}$ cup cold water
- 1 egg white

Method. Cut chicken in pieces, break the bones, place in saucepan with all the ingredients except the gelatin and egg white, cover with the water, and simmer until the meat falls from the bones. Press out as much of the juice as possible, strain, and allow to cool; remove all the grease and return to the fire. Reduce to one pint, add to the gelatin which has been soaked in cold water, stir in the beaten egg white, and allow to boil for five minutes. Strain into molds and set aside to congeal.

Plans should be made for the use of the boiled chicken in creamed dishes, or salads.

CREAM SOUPS

A thin cream sauce is combined with a vegetable purée for cream soup. Such soups are high in nutrient value because of the milk

used in their preparation. The caloric value may be enhanced by substituting cream for half of the milk, or adding butter to the soup just before it is served.

PREPARATION OF VEGETABLES FOR CREAM SOUPS

Cut vegetables into small pieces and add sufficient boiling water to cover them. Carrots should be scraped and diced; beets and potatoes, pared and diced; celery and asparagus must be cut into one inch pieces. Spinach is washed through several waters to remove grit and then steamed, instead of boiled; cauliflower should be broken into small flowerlets. Canned green peas may require more cooking to make them tender, as is the case with canned Lima beans, beets, and carrots.

Allow one half cup vegetable to a serving. Cook until very tender and press through a sieve. Combine one half cup of vegetable purée with three fourths cup of thin white sauce (page 644).

CREAM OF TOMATO SOUP

½ cup canned or stewed tomatoes	¾ cup thin white sauce (page 644)

Method. Press tomatoes through sieve, heat, and add gradually to the white sauce. If slight curdling should occur, beat vigorously with a rotary beater.

One eighth teaspoon baking soda may be added to the tomatoes before mixing with the white sauce to minimize curdling; however, this practice tends to diminish the ascorbic acid content.

CREAM OF POTATO SOUP

½ cup diced potatoes	½ cup thin white sauce
2 to 3 slices onion	1 sprig parsley

Method. Boil potatoes and sliced onion together in about one half cup of water. When potatoes and onion are soft, rub through sieve with water in which they were cooked. Heat white sauce in double boiler and add puréed potato mixture. Beat well; garnish with minced parsley.

CREAM OF CORN SOUP

½ small onion
1 tablespoon butter
½ cup canned corn
¾ cup milk
1 tablespoon flour
¼ teaspoon salt

Method. Cook sliced onion in butter until yellow, lift from butter, and allow to cook with corn and milk in a double boiler until tender. Press through sieve, return to boiler, and add flour which has been blended with butter until smooth. Heat and serve.

OYSTER STEW

1 cup milk
⅓ cup oysters
1 tablespoon butter
Salt and pepper

Method. Strain liquid from oysters to remove any sand and particles of shell. Cook oysters in liquid slowly until edges curl — about three to five minutes. Heat milk with butter in top of double boiler, add oysters to milk, season, and serve.

VEGETABLE SOUP

(Serves four)

2 to 3 pounds soup bone
1 teaspoon salt
¼ teaspoon pepper
1 sprig parsley
1 sprig thyme
Water to cover bone
2 tablespoons rice
1 cup diced carrot, celery, onion
1 cup diced potatoes
1 cup canned tomatoes

Method. Select bone with some meat, simmer for one hour in enough water to cover well, and add seasoning and all vegetables except potatoes and tomatoes; cook an hour and add the latter vegetables. Continue cooking until meat and vegetables are thoroughly tender. This makes a rich soup. If a thinner soup is desired, omit rice and cook just long enough to make the vegetables tender but not soft. For this thin soup the vegetables may be cut in strips instead of diced.

BEAN SOUP*

(Serves four)

½ cup white beans	1½ quarts water
¼ cup onion	¼ cup carrot
1 teaspoon parsley	Salt and pepper

Bones from pork roast, if available

Method. Soak beans overnight in enough water to cover. Drain, cover with cold water, bring slowly to boiling point, drain, and rinse with cold water. Put in large kettle with bones from pork roast and other ingredients and boil slowly three hours or until beans are soft. Remove pork bones and cook soup. Remove fat, reheat, and season with salt and pepper.

* Courtesy of Miss Alice Bradley, Principal of Miss Farmer's School of Cookery, Inc., and the Macmillan Company.

CHAPTER LXIII

Vegetables

Although they are low in fuel value, vegetables serve a most valuable purpose in the diet, furnishing much of the necessary mineral salts, vitamins, and cellulose essential for the proper regulation of the body processes. They, moreover, lend variety and interest to the dietary.

PREPARATION OF FRESH VEGETABLES

Vegetables should be prepared just before cooking in order to retain the maximum vitamin values. Only fresh, crisp products should be used. Remove any bad parts, wash the vegetables thoroughly and cut them into desired pieces.

Cook in a covered pan in boiling salted water, using as little water as possible. Strongly flavored vegetables as broccoli, Brussels sprouts, cabbage, cauliflower, onions, and turnips require cooking in an open pan with sufficient water to cover them. About one teaspoon salt is required for each quart of vegetables and water. The use of baking soda should be avoided since it is destructive of vitamins. Any juice which remains after cooking mildly flavored vegetables should be used for sauces or soups.

The time for cooking vegetables will vary with the degree of maturity. The following table gives approximate cooking time.

LENGTH OF TIME REQUIRED TO COOK VEGETABLES

Vegetable	Cooking Time Minutes	Vegetable	Cooking Time Minutes
Asparagus—tips	5 - 10	Corn on the cob	8 - 12
butts	15 - 25	Onions	25 - 30
Beans, string	20 - 30	Parsnips	25 - 30
Beets—young	30 - 45	Peas	15 - 25
old	1 - 2 hours	Potatoes, Irish	25 - 30
Broccoli	20 - 25	Potatoes, sweet	20 - 25
Brussels sprouts	10 - 15	Rutabagas	20 - 30
Cabbage	8 - 12	Spinach and other greens	5 - 8
Carrots	20 - 30	Squash, Hubbard	20 - 30
Cauliflower	10 - 12	Tomatoes	5 - 10
Celery	20 - 30	Turnips, white	20 - 30
Chinese cabbage	5 - 10		

FROZEN VEGETABLES

A small quantity of boiling salted water is used to cook frozen vegetables. The length of time required for cooking is somewhat shorter than that needed for fresh vegetables. In most cases preliminary thawing of the vegetable is unnecessary. Specific instructions are usually given with each package.

SERVICE OF VEGETABLES

Vegetables may be served in a variety of ways.

(1) Buttered: Add one to two teaspoons butter and a dash of salt and pepper to each half cup of diced, cooked vegetables.

(2) Creamed: Pour one fourth cup hot white sauce (medium) over one half cup hot cooked vegetable.

(3) Escalloped: Mix one half cup cooked vegetables with one fourth to one half cup medium white sauce (page 644). Place in a buttered baking dish and cover with bread or cracker crumbs. Bake in oven until crumbs are brown.

(4) Cheese sauce (page 645) is especially suitable for cabbage, cauliflower, or asparagus.

(5) Hollandaise sauce (page 646) lends a piquant flavor to asparagus, or broccoli.

HARVARD BEETS

1 tablespoon butter
½ tablespoon flour
¼ cup sugar
⅛ teaspoon salt
¼ cup mild vinegar
½ cup sliced beets

Method. Melt butter in top part of double boiler. Add flour, sugar, and salt, and stir in vinegar gradually. Cook for 10 to 15 minutes and add sliced beets. Allow to stand in warm place until sauce takes on a rich red color before serving.

GLAZED CARROTS

4 carrots
3 tablespoons sugar
1 tablespoon butter
1 teaspoon water

Method. Wash young carrots, scrape off the skin, boil until tender in small amount of boiling salted water, and drain. Put sugar, butter, and water in frying pan and cook over slow heat until thor-

oughly blended. Reheat the carrots in this mixture until they become glazed and slightly brown.

Whole sweet potatoes may be glazed in the same way.

CORN PUDDING

(Serves two)

1 cup canned corn
¾ cup milk
1 egg
1 tablespoon melted butter
½ teaspoon salt

Method. Stir all the ingredients together and turn into a buttered baking dish. Set in a pan of hot water and bake in a slow oven (325° F.) for three quarters of an hour or until a silver knife inserted into the center of the mixture comes out clean.

BAKED POTATO

1 medium size potato
1 teaspoon butter

Method. Scrub potato with a brush; dry and slightly grease the surface. Place in a moderately hot oven and bake about 45 to 50 minutes. The potato should feel tender upon pressure. When done, make an incision of one inch in the skin and gently press out the steam. Cover closely with a cloth and keep in a warm place until ready to serve. Put butter in the cut and serve very hot.

BAKED STUFFED POTATO

1 potato
1 teaspoon butter
1 tablespoon cream or milk
Salt and pepper
2 teaspoons grated cheese
Paprika

Method. Bake potato as directed above. Cut thin slice from side of potato and remove pulp from casing. Mix with butter and hot cream. Season with salt and pepper, and beat until creamy. Return to potato shell and sprinkle with cheese and paprika. Place in hot oven and cook until cheese is melted and browned.

MASHED POTATO

1 cooked medium size potato
1 teaspoon butter
1 tablespoon hot milk or cream
Salt and pepper

Method. Mash potato until free of lumps, add butter, hot cream, and salt and pepper to taste. Beat until creamy.

CANDIED SWEET POTATO

1 sweet potato
2 to 4 tablespoons brown sugar
$1\frac{1}{2}$ tablespoons butter

Method. Wash and cook sweet potato in boiling water for about 20 minutes. Drain, peel, and cut in halves lengthwise. Arrange in a buttered baking dish, sprinkle with brown sugar and pour melted butter over potato. Cook in a slow oven for about 20 minutes.

SWEET POTATOES AND APPLES

1 sweet potato
1 apple
1 tablespoon butter
2 to 4 tablespoons brown sugar
$\frac{1}{4}$ teaspoon cinnamon

Method. Scrub sweet potato, boil in water to cover for 15 minutes, and remove skin. Peel apple, cut into quarter inch slices and cook in boiling water until nearly done. Arrange alternate layers of potatoes and apples in a baking dish. Sprinkle each layer with bits of butter, brown sugar, and cinnamon. Bake in a moderate oven (350° F.) until potatoes and apples are tender — about 25 minutes.

HASH BROWN POTATO

2 tablespoons fat (bacon fat is good)
1 tablespoon finely chopped onion
1 cold boiled potato
Salt and pepper
Milk or water

Method. Heat fat in frying pan and cook onion in it until yellow and tender. Add finely chopped potato sprinkled with salt and pepper and press together firmly. A little water or milk will make the mixture hold together. Cook very slowly until a crisp brown crust forms on the bottom. Fold one side over the other as for an omelet and serve on a warm platter.

SPINACH SOUFFLÉ

$\frac{1}{2}$ cup thick white sauce
$\frac{1}{2}$ cup spinach purée
1 egg
$\frac{1}{4}$ teaspoon salt
$\frac{1}{4}$ teaspoon baking powder

Method. Prepare white sauce according to recipe on page 645. Stir in spinach purée, and add beaten egg yolk and salt. Remove from fire. Fold in beaten egg white and baking powder. Set in pan of hot water and bake in slow oven (325° F.) for about 20 minutes.

BROILED TOMATO

1 teaspoon butter	Salt and pepper
1 tablespoon fine bread crumbs	1 tomato

Method. Melt butter, brown bread crumbs, and season with salt and pepper. Wash tomato, remove core end, and cut in half. Dust with salt and pepper, and sprinkle bread crumbs on each half. Place on greased broiler rack about three inches below direct flame. Broil for about ten minutes or until tender.

SAUTÉED TOMATOES

¼ cup cracker crumbs	1 tomato
Salt and pepper	1 tablespoon butter

Method. Heat frying pan until very hot and grease lightly. Season crumbs with salt and pepper; dip slices of tomato in cracker crumbs, covering both sides well, and place in the pan. When one side is browned, turn over carefully to prevent breaking and allow the other side to brown. Reduce the heat and let the tomato cook gently for ten minutes. Place bits of butter upon each slice.

WHOLE TOMATO STUFFED WITH RICE

1 medium size tomato	1 teaspoon butter
2 tablespoons rice	Salt and pepper

Method. Remove the center from the tomato, dust the inside with salt and a very little pepper, and set aside. Boil the rice for about 20 minutes, drain, and add the tomato pulp, butter, salt, and pepper. Fill the center with rice. Set the tomato in a lightly buttered pan and bake in a moderate oven 20 minutes.

APPENDIX

Dietary Case Studies

The student nurse should be required to submit two or more case reports during the period she spends on the dietary service. The following forms, which are readily mimeographed at small cost, have been satisfactory for such purposes.

DIETARY CASE STUDY FOR STUDENT NURSES

Name of student.. Year....................

Date case study is due..

Patient's name.. Chart number........................

Diagnosis ....

Date of admission............................ Sex........... Age........... Height........

Date of operation, if any...

Date of discharge.................................. Attending doctor ....

....

MEDICAL HISTORY

SOCIAL HISTORY (Note especially those factors which may influence the patient's state of nutrition)

NUTRITIONAL HISTORY: This is to be a summary of the patient's nutrition before admission.

Appetite: Good................ Poor................ Excessive................

Typical meals: List kinds and amounts of each food taken at each meal

Breakfast: Time....................

Lunch: Time.....................

Dinner: Time....................

Food between meals: Kind.................................... How often?...............

Fluid intake (list amounts): Water.............. Milk.............. Tea..............

Coffee................ Other beverages...

Food idiosyncrasies and dislikes...

Eating habits: Regular................ Irregular................ Eats fast..............

Eats slowly.................. Chews well.................. Half chews.................

Eats alone..................... Eats with family..................... Sits.....................

Stands....................

Summary of food intake: Give an estimate of adequacy

DIETARY CASE STUDY (*Continued*)

COURSE IN THE HOSPITAL

Diet order									
	Date								
		8 A. M.	8 P. M.	8 A. M.	8 P. M.	8 A. M.	8 P. M.	8 A. M.	8 P. M.
Temperature									
Pulse									
Respiration									
Weight									
Food and Water Intake	CHO.								
	PRO.								
	FAT								
	Calories								
	Minerals								
	Fluids								
	Notes								
Medication									
Doctors' & Nurses' Notes									
Tests and Laboratory Analysis (Compare actual findings with normal values)									

TYPICAL DAY'S MENU

Breakfast

Midmorning nourishment, if any

Luncheon

Midafternoon nourishment, if any

Dinner

Bedtime nourishment, if any

FOOD VALUE OF TYPICAL DAY'S MENU

Food	Household Measure	Weight Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Ca Gm.	Fe Gm.	Vitamins				
									A I. U.	Thiamine Mg.	Riboflavin Mg.	Niacin Mg.	Ascorbic Acid Mg.

THEORETICAL CONSIDERATIONS

Etiology

Pathology

Characteristic symptoms

Treatment (general)

Dietary treatment

Prevention

FINAL DIET INSTRUCTION

DEFINITIONS OF NEW WORDS

WHAT I HAVE LEARNED FROM THIS STUDY

BIBLIOGRAPHY

Methods for Calculation of Food Values

The physician frequently requests that the intake of one or several of the nutrients be charted from day to day for certain patients. For some special diets, as the low fat diet, it is necessary to limit some of the constituents below a stated maximum, while in others, as the diabetic diet, all factors must be kept at the same level from day to day. In all of these situations the nurse must be able to quickly, yet accurately, make estimations of food value. Two methods of calculation will be illustrated here, namely, the methods used when reasonably exact information is desired, and the more approximate calculations which are suitable for day to day charting of intakes.

Before presuming to estimate food values, the student should read the foreword to the food tables (page 672) so that she can better appreciate the limitations of figures in any table. The composition of foods in this book is stated in percentage, that is, parts per 100. For example, if we find that potatoes contain 19 per cent carbohydrate, we know that each 100 Gm. of potato would contain 19 Gm. of carbohydrate, and that 100 pounds of potatoes would contain 19 pounds of carbohydrate. If the carbohydrate value of, let us say, 30 Gm. of potato is desired, it would be obtained thus: $.30 \times 19 = 5.7$ Gm. carbohydrate.

Calculation of Food Value of a Recipe. The calculation of the food value of a recipe is extremely simple once the method of percentage calculation has been mastered. The following steps should be followed:

1. List all foods used in the preparation of the recipe giving the household measure.

2. Convert the measure of each food to the nearest approximate weight in grams. By consulting the measure of food listed for 100 grams of the food in Table I one can determine the approximate weight readily. The table of equivalents on page 581 is also of value in these estimations.

3. Calculate the values for each food used and tabulate as shown in the accompanying illustration. Use only as many decimal places as are used in the original tables. For example, if a calculation shows a fat value of 4.35 Gm., the figure would be listed as 4.4 Gm. Whenever the unwanted digit is less than 5, it is dropped; 4.34 Gm. would be listed as 4.3 Gm.

4. Total the amount of each nutrient contained in the recipe.

5. List the number of portions which the recipe gives.

6. Divide the totals for each nutrient by the number of servings in order to determine the value of one serving.

7. This method may be used for the calculation of all of the nutrients, or for selected nutrients as illustrated below.

BAKING POWDER BISCUITS

Food	Household Measure	Weight Gm.	Pro. Gm.	Fat Gm.	Cho. Gm.	Calories	Ca Gm.	P Gm.	Fe mg.
Flour (patented)	½ cup	55	5.9	0.6	42	195	.08	.06	.7
Shortening	1 tablespoon	15		15.0		135			
Milk	3 tablespoons	45	1.6	1.8	2	31	.05	.04	.1
Baking powder	¾ teaspoon								
Salt	¼ teaspoon								
	4 biscuits		7.5	17.4	44	361*	.13	.10	.8
	1 biscuit		1.9	4.4	11	90	.03	.03	.2

* To check the caloric value:

$7.5 \times 4 = 30.0$ calories from protein
$17.4 \times 9 = 156.6$ calories from fat
$44 \times 4 = 176$ calories from carbohydrate
362.6 calories; a deviation of plus or minus 5 calories is permissible.

Estimation of Daily Intakes. The method for the calculation of weighed diets has been described in detail in the chapter on diabetes mellitus (Chapter XXVIII). The method for the estimation of protein, fat, carbohydrate, or caloric intake by patients on a measured diet is similar. No decimal places are used in these computations. Table II is sufficiently exact for the protein, fat, and carbohydrate values. The calories may be obtained by consulting Table I for each individual food, or by multiplying the total carbohydrate, fat, and protein figures by the factors 4, 9, and 4, respectively. Let

us suppose that the physician wishes protein, fat, carbohydrate, and calories charted for a patient. The steps in the calculation are as follows:

1. Note measures of food served to the patient. Check tray after each meal to ascertain what foods were eaten and which were refused.

2. Estimate the protein, fat, and carbohydrate values by using the figures from Table II.

3. Total the amounts of protein, fat, and carbohydrate.

4. Estimate the calories by using Table I. Round off the figures, as 78 = 80, or 77 = 75. The calories may also be obtained as follows:

Total protein × 4	=	calories
Total carbohydrate × 4	=	calories
Total fat × 9	=	calories
TOTAL		CALORIES

BREAKFAST

	Food Served	Food Eaten	Weight (approx.) Gm.	Pro. Gm.	Fat Gm.	Cho Gm.	Calories
Grapefruit juice	½ glass	½ glass	100	1		10	45
Cornflakes	1 cup	1 cup	20	2		15	70
Milk	1 cup	½ cup	100	3	4	5	70
Bread	1 slice	1 slice	30	3	1	15	80
Jelly	1 tablespoon	0					
Butter	1 square	1 square	8		7		60
		TOTALS		9	12	45	325*

* The caloric value may also be obtained thus:

$9 \times 4 = 36$ calories from protein
$12 \times 9 = 108$ calories from fat
$45 \times 4 = 180$ calories from carbohydrate
324 calories

PROBLEMS

1. If a diet contains 250 Gm. of carbohydrate, 90 Gm. of protein, and 110 Gm. of fat, how many calories does it contain?

2. If a diet of 2500 calories contains 200 Gm. of carbohydrate and 70 Gm. of protein, how many Gm. of fat does it contain?

3. Calculate the carbohydrate, protein, fat, and caloric values of each of the following:

65 Gm. potato
35 Gm. dried lima beans
85 Gm. round steak

4. How much of each of the following foods will supply 6 Gm. of protein: wholewheat bread, veal chop, egg white, milk, soy beans, peanuts?

5. How much of each of the following foods will supply 500 I.U. of vitamin A: egg yolk, butter, milk, broccoli, sweet potato?

5. Calculate the carbohydrate, protein, fat, and caloric value of the following supper: 2 poached eggs, 1 slice toast, 2 teaspoons butter, 1 glass milk, 1 fresh peach. Use Table I for all calculations. Note the amount of time necessary for this calculation.

7. Calculate the food value of the supper listed in problem 6, using Table II for all calculations. Compare the time necessary by this method with that required for problem 6.

Composition of Foods

FOREWORD

A table of food values is one of the very valuable tools needed by the doctor, nurse, and dietitian, since it is the means by which diets can be carefully planned and checked for nutritional adequacy. As with any tool, however, intelligent use comes with a knowledge of the possibilities and limitations of the food table.

It is obvious at the outset that no two samples of even the same type of food are exactly alike in their chemical composition. For example, two apples from the same tree may differ somewhat in their composition even though they look very much alike. Then, again, two apples of different varieties might differ even more widely. The soils on which they are grown may vary markedly the concentration of certain constituents. The degree of maturity is of importance. Climate is another influencing factor. So then, for a freshly picked apple, or for any fresh product, the factors of variety, soil, maturity, and climate each determine food value. In animal foods the proportion of fat to lean is a factor in the composition of the product.

It is further evident that variations in composition occur subsequent to the production of the food. The influence of storage on certain nutrients, as ascorbic acid, is very great. The method of preservation — cold storage, dehydration, canning — and the method of preparation before the food is eaten each modify the final food value. The amount of water used in cooking and the length of time for cooking may affect the final mineral and vitamin concentration.

Even when the exact composition of a food is known there may be variations in value to the several individuals eating them. Values by chemical analyses do not necessarily represent availability to the body. Iron is a case in point, since much of the iron in many foods is nutritionally unavailable. The ability of some individuals to utilize foods is greater than that of others.

In view of these points, it should be realized by the doctor, nurse, and dietitian that the table of food values represents the best available average of many determinations rather than values for one specific sample of food. An average based on 100 chemical determinations is certainly apt to be more significant and representative of that class of foods than an average based on 10 determinations.

The figures for protein, fat, carbohydrate, fiber, calories, and water are derived in large part from *Proximate Composition of American Food Materials,* United States Department of Agriculture Circular No. 549, by Chatfield and Adams. Since most of the proteins in foods contain 16 per cent nitrogen, the protein values were obtained by multiplying the nitrogen content of the food by the factor 6.25. The figures for fat include a small proportion of non-fat material, since the ether extraction of food dissolves these materials as well as fat. The carbohydrate values are obtained by difference; that is, by subtracting the protein, fat, ash, and water from the total weight of the food. The figures, therefore, include not only the available carbohydrate but fiber and other indigestible material in varying amounts. British and American food tables are at wide variance at the present time with respect to carbohydrate values, and it is hoped that unification can ultimately be realized. No attempt has been made to differentiate between total carbohydrate and available carbohydrate since quantitative data is not as abundant as might be hoped. It is generally assumed that the difference between total carbohydrate and fiber represents, in most instances, available carbohydrate. The purposes for which a nurse uses food tables are such that no serious error is introduced if total carbohydrate values are used. The caloric values in these tables were obtained by multiplying the protein, fat, and carbohydrate values by the factors 4, 9, and 4, respectively, and totalling these figures.

The data for the vitamins are perhaps less stable than those for the other nutrients. In the first place, some methods for the determination of vitamins are more reliable than others, and, secondly, tremendous variations in sampling have no doubt occurred from one laboratory to another. It has been customary to list ranges of vitamin values rather than averages in order to indicate the extent of deviations. However, the student nurse does not usually possess

the necessary background for the interpretation of such ranges. The authors have, therefore, listed a single value for each vitamin, fully realizing the many factors which might alter that value.

The concentrations of some of the newer vitamins such as biotin, pyridoxine, choline, inositol, pantothenic acid are not listed for several reasons. At the present writing much work remains to be done on the perfection of methods for the determination of some of these factors. Reliable figures are not numerous enough as yet to be able to draw conclusions with respect to values. Moreover, very little is known of the daily requirements of these nutrients. Until these points have been clarified, it is unreasonable as well as wasteful of time to concern the nurse or the therapeutic dietitian with dietary estimations of these factors. Until the research workers have established reliable data for these factors as well as the importance of these nutrients in normal nutrition, the nurse should not need to worry about them.

The figures in these tables are for edible portions of raw, fresh foods unless otherwise stated. For all practical purposes the values for frozen meats, fruits, and vegetables are similar to those for fresh foods and are not listed separately. The data for canned products are based on total content of the can and the values thus apply to servings which have a proportionate share of the liquid in the can. The variations in cooking procedures are so many that values for most cooked foods have not been included. No attempt has been made in this book to list the composition of the numerous brands of products available today. Manufacturers are usually able to supply such information.

The values are given for 100 grams of food in every case. The approximate household equivalent for this amount of food is stated to facilitate calculations.

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	Approximate Measure	Water Gm.	Protein Gm.	Fat Gm.	Carbohydrate Total Gm.	Carbohydrate Fiber Gm.	Calories
Beverages Including Fruit Juices							
Apple juice	½ cup	87	.1	.0	13	—	52
Chocolate, bitter	3⅓ squares	2	5.5	52.9	18	2.6	570
Cocoa, dry	⅞ cup	4	9.0	18.8	31	4.8	329
Cocoa, ½ milk	½ cup scant	—	1.8	2.5	10	—	68
Cocoa, all milk	½ cup scant	—	3.3	4.3	12	—	100
Ginger ale	½ cup scant	91	—	—	9	—	36
Grape juice, commercial	½ cup scant	81	.4	.0	18	—	74
Grapefruit juice							
Fresh	½ cup scant	89	.4	.1	10	—	42
Canned							
Unsweetened	½ cup scant	88	.4	.1	11	—	47
Sweetened	½ cup scant	83	.4	.1	16	—	67
Kola beverages	½ cup scant	88	—	—	12	—	48
Lemon juice	½ cup scant	89	.9	.6	9	—	45
Lime juice	½ cup scant	86	.8	.1	12	—	52
Loganberry juice	½ cup scant	89	.6	.0	10	—	42
Orange juice	½ cup scant	86	.6	.0	10	—	42
Orange and grapefruit juice, canned	½ cup scant	86	.6	.2	12	—	52
Pineapple juice, canned	½ cup scant	86	.2	.2	13	—	55
Prune juice, canned	½ cup scant	80	.4	.0	19	—	78
Raspberry juice	½ cup scant	88	.2	.0	11	—	45
Strawberry juice	½ cup scant	94	.2	.0	5	—	21
Tomato juice							
Fresh	½ cup scant	94	1.0	.2	4	—	22
Canned	½ cup scant	94	1.0	.2	4	—	22
Cereals and Cereal Products							
Breads							
Baking powder biscuit	3 medium	42	7.3	7.5	43	.2	269
Boston brown bread	2 slices	48	4.9	2.5	41	.5	207
Cornbread with egg	2 pieces 2″	—	7.8	6.9	45	—	273
Graham bread	3 – 4 slices	37	9.0	3.0	49	1.0	259
Raisin bread	3 – 4 slices	33	9.0	3.0	53	—	275

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Beverages Including Fruit Juices
—	—	—	57	0.02	—	—	2	Apple juice
.10	.46	3.0	60	.05	.24	1.0	0	Chocolate, bitter
.11	.71	2.7	0	.09	.45	1.50	0	Cocoa, dry
.06	.07	.2	86	.02	.08	.09	0	Cocoa, ½ milk
.11	.11	.3	170	.05	.16	.11	0	Cocoa, all milk
—	—	—	—	—	—	—	—	Ginger ale
.01	.01	.3	—	.03	.08	—	2	Grape juice, commercial
								Grapefruit juice
.02	.02	.2	0	.05	.02	.21	45	Fresh
								Canned
.02	.02	.3	0	.05	.02	.18	40	Unsweetened
.02	.02	.3	0	.05	.02	.18	40	Sweetened
—	—	—	—	—	—	—	—	Kola beverages
.02	.01	.6	0	.02	.00	.13	45	Lemon juice
.02	.01	.6	26	.02	.00	.20	37	Lime juice
.01	.00	.1	—	—	—	—	26	Loganberry juice
.02	.02	.4	150	.07	.02	.22	45	Orange juice
.02	.02	.4	10	.04	.01	.18	34	Orange and grapefruit juice canned
.02	.01	.1	50	.05	.02	.18	9	Pineapple juice, canned
.01	.02	3.0	1200	.05	—	.43	—	Prune juice, canned
.02	.01	—	100	.03	—	—	15	Raspberry juice
—	—	—	15	—	—	—	60	Strawberry juice
								Tomato juice
.01	.02	.6	1000	.09	.05	.10	21	Fresh
.01	.02	.4	850	.05	.03	.10	13	Canned
								Cereals and Cereal Products
								Breads
.05	.08	1.7	80	.25	.22	1.90	—	Baking powder biscuit
.13	.19	3.0	120	.15	.07	.63	—	Boston brown bread
.08	.13	.7	310	.17	.22	1.15	—	Cornbread with egg
.08	.26	2.6	—	.30	.13	3.54	—	Graham bread
.05	.10	2.0	20	.22	.14	1.90	—	Raisin bread

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					Total	Fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Rye bread, light	3 – 4 slices	38	8.9	2.0	50	5	254
White bread, plain	3 – 4 slices	36	8.5	2.0	52	—	260
White bread, enriched	3 – 4 slices	36	8.5	2.0	52	—	260
Wholewheat bread 100 per cent	3 – 4 slices	37	9.7	1.0	47	1.0	236
Zwieback	12 pieces	5	10.9	8.6	74	.3	417
Crackers, butter	20 crackers	6	9.6	9.6	73	.2	417
Crackers, graham	10 crackers	6	8.0	10.0	74	.8	418
Crackers, Ry-Krisp	16, $1\frac{7}{8}''$ x $3\frac{5}{8}''$	6	12.0	1.0	74	1.8	353
Crackers, saltine	25, 2″ square	5	9.2	11.8	71	.4	427
Crackers, soda	12, $2\frac{1}{2}''$ square	6	9.6	9.6	73	.2	417
Muffins, plain	3 average	38	8.3	8.8	44	—	288
Pancakes	2, 4″ diam.	65	4.8	3.0	26	—	150
Rolls, cinnamon	2 average	30	7.8	5.4	56	—	304
Rolls, Parkerhouse	3, 2″	29	8.2	6.1	54	.2	304
Waffles	2, 5″ diam.	38	8.5	21.7	32	—	356
Breakfast Foods, Grains							
Barley, pearled	$\frac{1}{2}$ cup	11	8.2	1.0	79	.8	358
Bran, All, Kellogg	$1\frac{3}{4}$ cups	7	15.9	4.2	66	8.4	365
Cornflakes	6 cups	9	7.9	.7	80	.5	358
Farina, dry	$\frac{5}{8}$ cup	11	11.0	.9	79	.3	368
Hominy grits, dry	7 tablespoons	11	8.5	.8	79	.4	357
Hominy, canned	$\frac{1}{2}$ cup	83	1.8	.2	15	.1	68
Macaroni, dry	10 pieces, 9″	11	13.0	1.4	74	.4	361
Macaroni, cooked	$\frac{1}{2}$ cup	75	3.7	.4	19	.1	94
Noodles, egg, dry	$\frac{1}{2}$ cup	9	11.1	2.7	63	.3	321
Oatmeal, dry	$1\frac{1}{3}$ cups	8	15.4	7.4	68	1.2	400
Oatmeal, cooked	$\frac{1}{2}$ cup	85	2.3	1.2	11	.2	64
Popcorn, popped	9 cups	4	11.4	5.2	78	1.7	404
Rice, brown, dry	$\frac{1}{2}$ cup	12	7.5	1.7	78	.6	357
Rice, polished, dry	$\frac{1}{2}$ cup	12	7.6	.3	79	.2	347
Rice, boiled	$\frac{2}{3}$ cup	74	2.2	.1	23	.1	102
Rice polishings	$\frac{3}{4}$ cup	9	11.6	10.1	64	2.2	393
Rice, puffed	5 cups	9	6.7	.3	83	.3	362
Spaghetti, dry	$\frac{1}{2}$ cup	11	13.0	1.4	74	.4	361
Tapioca	7 tablespoons	—	.6	.2	86	.1	348
Wheat, cracked, dry	$\frac{3}{4}$ cup	9	11.7	2.0	76	1.8	369
Wheat germ	$\frac{3}{4}$ cup	—	25.2	10.0	50	2.5	391

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.02	.15	1.6	—	.14	.03	.80	—	Rye bread, light
.03	.10	.8	—	.07	.03	.80	—	White bread, plain
.06	.11	1.8	—	.24	.15	2.20	—	White bread, enriched
.05	.25	2.8	—	.28	.12	3.00	—	Wholewheat bread 100 per cent
.10	.15	1.2	—	—	—	—	—	Zwieback
—	—	1.6	—	—	—	—	—	Crackers, butter
.02	.20	2.0	—	.03	.12	1.50	—	Crackers, graham
.07	.40	4.0	—	.32	.80	1.54	—	Crackers, Ry-Krisp
.02	.10	1.5	—	—	—	—	—	Crackers, saltine
.02	.10	1.5	—	.16	.05	.59	—	Crackers, soda
.08	.12	.8	310	.25	.25	1.68	—	Muffins, plain
.05	.07	1.0	135	.14	.15	1.00	—	Pancakes
.06	.09	1.1	310	.18	.18	1.35	—	Rolls, cinnamon
.06	.10	.8	5	.21	.26	2.64	—	Rolls, Parkerhouse
.10	.14	1.0	300	.22	.28	1.35	—	Waffles
								Breakfast Foods, Grains
.02	.19	2.0	0	.05	.12	2.75	0	Barley, pearled
.12	1.22	11.6	—	.40	.36	21.15	0	Bran, All, Kellogg
.02	.06	2.7	—	.04	.09	1.40	—	Cornflakes
.02	.16	.8	0	.06	.06	.86	0	Farina, dry
.01	.07	.9	300	.13	.02	1.37	0	Hominy grits, dry
02	.02	.2	—	.00	.01	.02	—	Hominy, cooked
.02	.14	1.2	0	.10	.06	2.03	—	Macaroni, dry
.00	.03	.3	0	.03	.02	.60	—	Macaroni, cooked
.02	.12	1.4	180	.07	.06	2.09	—	Noodles, egg, dry
.07	.39	5.2	0	.63	.14	1.30	0	Oatmeal, dry
.01	.07	.6	—	.13	.02	.22	0	Oatmeal, cooked
—	—	—	—	—	—	—	—	Popcorn, popped
.08	.34	2.0	75	.30	.08	6.90	0	Rice, brown, dry
.01	.09	.7	0	.06	.06	.66	0	Rice, polished, dry
.00	.02	.2	0	.02	.08	1.0	—	Rice, boiled
.06	1.45	16.0	—	2.20	.23	96.6	—	Rice polishings
.01	.10	.9	—	.01	.06	.66	—	Rice, puffed
.02	.14	1.2	—	.10	.06	2,03	—	Spaghetti, dry
.02	.09	1.6	—	—	.10	—	—	Tapioca
.05	.40	4.0	—	.51	.16	7.00	—	Wheat, cracked, dry
.07	1.05	10.0	100	1.86	.70	6.80	—	Wheat germ

TABLE I — COMPOSITION

(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					Total	Fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Wheat, puffed	6 cups	8	13.4	1.7	76	1.8	373
Wheat, shredded	3½ biscuits	8	10.4	1.4	79	2.1	374
Flours and Meals							
Barley flour	⅞ cup	10	10.2	1.7	77	.7	364
Buckwheat flour, dark	⅔ cup	12	12.4	2.4	72	1.0	357
Buckwheat flour, light	⅔ cup	12	6.3	1.1	80	.4	355
Cornmeal, whole, yellow	¾ cup	12	9.1	3.7	74	2.0	365
Cornmeal, whole, white	¾ cup	12	9.1	3.7	74	2.0	365
Cornstarch	⅔ cup	12	.5	.2	87	.1	352
Gluten flour	¾ cup	9	41.4	1.9	47	.4	371
Graham flour	⅞ cup	11	13.0	2.0	72	1.8	358
Rice flour	7/3 cup	12	7.4	.5	80	.4	354
Rye flour, medium	⅞ cup	11	11.0	1.2	76	1.5	359
Soybean meal, low fat	1 cup	—	42.2	1.0	15	—	238
Soybean meal, ground whole beans	1 cup	9	35.7	18.0	12	5.4	353
Wheat flour, patent	1 cup sifted	12	10.8	.9	76	.3	355
Wheat flour, enriched	1 cup sifted	12	10.8	.9	76	.3	355
Wholewheat flour	⅞ cup	11	13.0	2.0	72	1.8	358
Dairy Products and Eggs							
Butter	½ cup scant	16	.6	81.0	0	0	733
Cream, light	7 tablespoons	73	2.5	20.0	4	0	206
Cream, heavy	7 tablespoons	59	2.3	35.0	3	0	336
Cheese							
American cheddar	4 slices 3½″ x 3¼″ x ⅛″	39	23.9	32.3	2	0	394
Camembert	6 tablespoons	51	19.7	25.2	0	0	306
Cottage, skim milk	5–6 tablespoons	74	19.2	.8	4	0	100
Cream cheese	6 tablespoons	53	7.1	36.9	2	0	368
Limburger	5–6 tablespoons	38	23.5	32.4	1	0	390
Parmesan	6–7 tablespoons grated	29	36.3	27.4	2	0	400

gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.04	.42	4.1	—	.09	.08	4.21	—	Wheat, puffed
.04	.32	4.5	—	.21	.15	4.19	—	Wheat, shredded
								Flours and Meals
.08	.37	5.1	—	—	—	—	—	Barley flour
.01	.18	1.2	—	.74	—	4.40	—	Buckwheat flour, dark
.01	.18	1.2	—	.37	—	4.40	—	Buckwheat flour, light
.02	.14	.9	750	.23	.08	.80	—	Cornmeal, whole, yellow
.02	.14	.9	—	.13	.07	1.33	—	Cornmeal, whole, white
—	.09	—	—	—	—	—	—	Cornstarch
.08	.20	—	—	—	—	2.50	—	Gluten flour
.04	.31	3.7	10	.47	.11	4.31	—	Graham flour
.01	.10	.9	—	.04	—	2.40	—	Rice flour
.02	.29	1.4	—	.19	.08	.97	—	Rye flour, medium
.33	.62	—	40	.73	.44	5.30	—	Soybean meal, low fat
.22	.58	2.7	350	1.46	.85	—	—	Soybean meal, ground whole beans
.02	.11	1.3	0	.08	.04	1.00	0	Wheat flour, patent
.02	.10	2.9	0	.44	.26	3.50	0	Wheat flour, enriched
.04	.31	3.5	10	.47	.11	4.41	0	Wholewheat flour
								Dairy Products and Eggs
.02	.02	.2	3190	.00	.01	.11	0	Butter
.09	.08	.2	1250	.03	.13	—	2	Cream, light
.09	.07	.2	2250	.03	.15	—	1	Cream, heavy
								Cheese
.87	.61	1.3	1430	.04	.55	.03	0	American cheddar
.68	.50	.9	3610	.00	.83	1.60	0	Camembert
.08	.26	.2	70	.01	.13	—	0	Cottage, skim milk
.03	.04	.1	2000	.02	.20	.06	0	Cream cheese
.44	.57	—	1370	—	.35	.14	0	Limburger
1.22	.77	1.9	1350	.03	.53	.11	0	Parmesan

	Approximate Measure	Water	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Calories
		Gm.	Gm.	Gm.	Gm.	Gm.	
Roquefort	1½″x1¼″x3½″	37	21.7	33.2	1	0	390
Swiss	4 slices 3½″ x 3¼″ x ⅛″	34	28.6	31.3	2	0	404
Milk							
Buttermilk, genuine	½ cup scant	91	3.5	.5	5	0	37
Cow's milk							
Fresh whole	½ cup scant	87	3.5	3.9	5	0	69
Fresh skim	½ cup scant	91	3.5	.2	5	0	36
Condensed	½ cup scant	27	8.1	8.4	55	0	328
Evaporated	½ cup scant	74	7.0	7.9	10	0	139
Dry, whole	1 cup scant	4	25.8	26.7	38	—	496
Dry, skim	1 cup scant	4	35.6	1.0	52	—	359
Malted, plain	¾ cup	3	14.6	8.5	71	.3	419
Mellin's food	⅞ cup	—	10.0	—	71	—	329
Goat's milk, fresh	½ cup scant	87	3.3	4.2	5	—	71
Human milk, fresh	½ cup scant	88	1.4	3.7	7	—	68
Eggs							
Whole	2 eggs	74	12.8	11.5	1	—	159
White	3½ whites	88	10.8	.0	1	—	47
Yolk	7 yolks	49	16.3	31.9	1	—	356
Desserts							
Cake, angel	2 pieces	32	8.4	.3	59	0	272
Cake, chocolate	1 piece 2¾″ square, iced	—	4.9	12.2	69	—	405
Cake, plain	3″ square	27	6.4	8.2	57	.1	327
Cake, sponge	3 slices	32	7.9	5.0	54	.2	293
Cookies, crisp, thin	6 medium	4	7.8	18.0	70	—	473
Cookies, hermits	6 medium	—	5.1	12.9	54	—	353
Cookies, oatmeal, rich	6 small	—	14.1	12.0	87	—	512
Cookies, sandwich, commercial	10	2	5.0	19.6	72	—	484
Cookies, soft, thick	8 medium	8	6.8	10.5	73	—	414
Custard, baked or soft	½ cup	77	5.5	5.5	17	0	140
Doughnuts	3 small	19	6.6	21.0	53	.2	427
Gingerbread	1 slice 2½″ square	30	4.2	11.9	51	.1	328
Ice cream, vanilla	½ cup	62	3.9	13.0	20	—	213

OF FOODS (*Continued*)
gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.72	.52	1.0	4010	.03	.45	1.24	0	Roquefort
1.09	.81	1.2	2320	.03	.40	.07	0	Swiss
								Milk
.11	.10	.2	20	.03	.18	.11	1	Buttermilk, genuine
								Cow's milk
.12	.09	.2	170	.04	.18	.11	1	Fresh whole
.12	.10	.3	10	.05	.20	.08	0	Fresh skim
.29	.23	.5	430	.05	.42	.20	1	Condensed
.24	.19	.4	410	.05	.36	.17	1	Evaporated
.95	.72	1.6	1410	.31	1.59	.66	7	Dry, whole
1.24	.98	2.0	60	.34	1.93	1.06	7	Dry, skim
.36	.35	2.1	—	.34	.50	—	—	Malted, plain
.01	.21	14.2	—	—	—	—	—	Mellin's food
.13	.10	.2	170	.06	.07	.25	1	Goats' milk, fresh
.03	.02	.2	350	—	.06	.26	6	Human milk, fresh
								Eggs
.06	.21	2.7	990	.14	.37	.06	0	Whole
.02	.01	.1	0	0	.23	.08	0	White
.16	.52	7.6	2800	.42	.29	.04	0	Yolk
								Desserts
.01	.03	.3	—	.01	.14	.22	—	Cake, angel
.07	.10	.8	280	.05	.14	.30	—	Cake, chocolate
.04	.06	1.0	360	.14	.13	.89	—	Cake, plain
.03	.11	1.6	400	.07	.15	.20	—	Cake, sponge
.04	.13	1.1	170	.01	.04	—	—	Cookies, crisp, thin
.03	.01	.9	—	—	—	—	—	Cookies, hermits
.06	.33	2.9	70	.13	.12	.12	—	Cookies, oatmeal, rich
—	—	—	—	—	—	—	—	Cookies, sandwich commercial
.03	.06	1.1	95	.03	.04	—	—	Cookies, soft, thick
.10	.11	.8	380	.09	.22	.11	1	Custard, baked or soft
.07	.14	1.6	190	.23	.17	1.68	—	Doughnuts
.05	.07	3.0	70	.18	.19	1.27	—	Gingerbread
.08	.06	.2	330	.03	.26	.11	—	Ice cream, vanilla

	Approximate Measure	Water Gm.	Protein Gm.	Fat Gm.	Carbohydrate Total Gm.	Carbohydrate Fiber Gm.	Calories
Ice, lemon or orange	½ cup	73	.1	.1	27	—	109
Sherbert, lemon milk	½ cup	67	2.3	2.7	28	—	146
Jello	⅔ cup	77	2.5	—	20	—	90
Gelatin, lemon	½ cup	79	1.2	—	19	—	81
Junket	½ cup	77	3.5	3.9	15	—	109
Pie, apple	⅛ of 9″ pie	—	2.0	10.5	32	—	231
Pie, berry or cherry	⅛ of 9″ pie	—	2.0	9.0	49	—	285
Pie, cream	⅛ of 9″ pie	—	5.5	8.9	29	—	218
Pie, lemon meringue	⅛ of 9″ pie	—	4.5	10.5	60	—	353
Pudding, bread	½ cup scant	—	6.0	4.7	24	—	162
Pudding, cornstarch	½ cup scant	—	2.7	3.1	23	—	130
Pudding, pineapple Bavarian cream	½ cup	—	2.6	4.3	33	—	181
Pudding, rice with raisins	½ cup scant	—	5.8	4.9	47	—	255
Pudding, tapioca	½ cup scant	—	4.5	4.5	20	—	139
Fats and Oils							
French dressing	½ cup	65	—	35.0	—	0	315
Lard	½ cup	0	0	100.0	0	0	900
Lard substitute (Crisco, Spry, etc.)	½ cup	0	0	100.0	0	0	900
Mayonnaise	⅜ cup	16	1.5	78.0	3	0	720
Oil, corn, cottonseed	½ cup	0	—	100.0	0	0	900
Oleomargarine with added A	7 tablespoons	16	0.6	81.0	0	0	733
Salt pork	about ¼ lb. A.P	8	3.9	85.0	0	0	781
Suet	about ¼ lb. A.P.	5	1.7	93.0	0	0	844
Fish and Sea Foods							
Raw Fish							
Bass, black	3″ x 3″ x ¾″	77	20.6	1.8	0	0	99
Blackfish	3″ x 4″ x ¾″	79	18.7	1.3	0	0	86
Bluefish	3″ x 3″ x ¾″	75	20.5	4.0	0	0	118
Catfish	large serving	77	19.0	2.5	0	0	98
Caviar, pressed	4 tablespoons	36	34.4	16.7	0	0	288

OF FOODS (*Continued*)
gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.01	.01	.2	45	.02	.02	.09	15	Ice, lemon, orange
.08	.06	.2	130	.04	.12	.06	6	Sherbet, lemon, milk
0	0	0	0	0	0	0	—	Jello
—	0	—	—	.01	—	.01	5	Gelatin, lemon
.12	.09	.2	157	.05	.20	.08	1	Junket
.01	.03	.4	70	.02	.03	.56	0	Pie, apple
.01	.03	.5	70	.03	.04	.32	—	Pie, berry or cherry
.08	.10	.6	300	.06	.18	.18	—	Pie, cream
.02	.06	.8	260	.04	.05	.20	—	Pie, lemon, meringue
.10	.12	.6	404	.09	.20	.70	—	Pudding, bread
.11	.08	.5	240	.06	.23	.09	—	Pudding, cornstarch
.03	.03	.2	640	.03	.01	—	10	Pudding, pineapple Bavarian cream
.15	.14	.6	205	.08	.24	.26	—	Pudding, rice with raisins
.09	.09	.5	320	.06	.21	.08	—	Pudding, tapioca
								Fats and Oils
0	0	0	0	0	0	0	0	French dressing
0	0	0	5	0	0	0	0	Lard
0	0	0	0	0	0	0	0	Lard substitute
.01	.04	.6	210	.03	.04	0	0	Mayonnaise
0	0	0	0	0	0	0	0	Oil, corn, cottonseed
—	—	—	1990	0	0	0	0	Oleomargarine
—	—	—	—	—	—	—	—	Salt pork
—	—	—	—	—	—	—	—	Suet
								Fish and Sea Foods
								Raw Fish
.02	.22	1.1	—	—	—	—	—	Bass, black
.02	.22	1.0	—	—	—	—	—	Blackfish
.02	.24	1.0	—	—	.20	—	—	Bluefish
.02	.23	2.3	—	—	—	—	—	Catfish
.14	.18	—	—	—	—	—	—	Caviar, pressed

(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					total	fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Clams, long	4 – 6 medium	81	13.6	1.7	2	0	78
Clams, round	6 medium	80	11.1	.9	6	0	76
Codfish, fresh	$4\frac{1}{2}'' \times 2\frac{1}{4}'' \times \frac{1}{2}''$	83	16.5	.4	0	0	70
Codfish, salt	$4\frac{1}{2}'' \times 2\frac{1}{4}'' \times \frac{1}{2}''$	52	29.0	.7	0	0	122
Cod, dried	4 large servings	12	81.8	2.8	0	0	352
Crabs, raw or cooked	$\frac{2}{3}$ cup	80	16.1	1.6	1	0	81
Crabmeat, canned	$\frac{5}{8}$ cup	77	16.9	2.9	1	0	99
Eel, salt water	large serving	72	18.6	9.1	0	0	156
Eel, smoked	large serving	50	18.6	27.8	0	0	325
Flounder	1 fillet	83	14.9	.5	0	0	64
Frog legs	large serving	82	16.4	.3	0	0	68
Haddock, fresh	$3'' \times 2'' \times \frac{3}{4}''$	82	17.2	.3	0	0	72
Haddock, smoked	large serving	73	23.2	.4	0	0	96
Halibut steak	$2\frac{1}{2}'' \times 2\frac{1}{2}'' \times 1''$	75	18.6	5.2	0	0	121
Herring, Atlantic	1 medium fish	73	19.0	6.7	0	0	136
Herring, kippered	1 medium	61	22.2	12.9	0	0	205
Herring, pickled	2 small	59	20.4	15.1	0	0	218
Herring, smoked	1 bloater	64	19.6	12.4	0	0	190
Lobster, fresh	1 large	79	16.2	1.9	1	0	86
Lobster, canned	$\frac{2}{3}$ cup	77	18.4	1.3	0	0	86
Mackerel, Atlantic	large serving	68	18.7	12.0	0	0	183
Mackerel, salt	large serving	43	18.5	25.1	0	0	300
Oysters	4 – 6 medium	80	9.8	2.0	6	0	81
Perch, fresh, white	large serving	76	19.3	4.0	0	0	113
Pickerel	large serving	80	18.7	.5	0	0	79
Pike, common	large serving	80	18.7	.6	0	0	80
Salmon, Atlantic	large serving	64	22.5	13.4	0	0	211
Salmon, Chinook	$3'' \times 4'' \times \frac{3}{4}''$	63	17.4	16.5	0	0	218
Salmon, canned	1 cup scant	67	20.6	9.6	0	0	169
Sardines, canned	10-11 medium	57	25.7	11.0	1	0	207
Scallops	6 small	80	14.8	.1	3	0	72
Shad	large serving	70	18.7	9.8	0	0	163
Shad roe	$\frac{1}{2}$ medium	71	20.9	3.8	0	0	118
Shrimp, canned	$\frac{1}{2}$ cup	78	17.8	.8	1	0	82
Smelts	3 – 4 medium	79	17.6	1.8	0	0	87
Sturgeon	large serving	79	18.1	1.9	0	0	90
Terrapin	large serving	75	21.2	3.5	0	0	116
Trout, brook	$3'' \times 3'' \times 1''$	78	19.2	2.1	0	0	96
Tuna fish, canned	$\frac{3}{4}$ cup	63	24.2	10.8	0	0	194
Turtle, green	1 serving	80	19.8	.5	0	0	84
Whitefish	$3'' \times 2'' \times 1''$	70	22.9	6.5	0	0	150

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thia-mine mg.	Ribo-flavin mg.	Niacin mg.	Ascorbic Acid mg.	
.12	.11	4.1	200	.03	.02	1.08	6	Clams, long
.11	.12	4.4	200	.03	.02	1.08	6	Clams, round
.01	.19	3.0	0	.10	.07	2.17	2	Codfish, fresh
.03	—	—	—	—	—	—	—	Codfish, salt
—	—	—	—	—	—	—	—	Cod, dried
.02	.19	1.0	—	.12	.35	2.70	—	Crabs, raw or cooked
.02	.18	.9	—	.23	.15	2.16	—	Crabmeat, canned
.01	.21	1.1	4830	.14	.06	—	—	Eel, salt water
.02	.21	1.0	—	.14	.07	—	—	Eel, smoked
.03	.16	1.0	—	.08	.20	3.84	—	Flounder
.02	.19	.4	—	—	—	—	—	Frog legs
.02	.20	.9	0	.09	.12	.90	0	Haddock, fresh
.02	.20	.9	6	.09	.16	—	—	Haddock, smoked
.01	.21	.9	10	.09	.17	3.00	—	Halibut steak
.02	.22	1.1	68	.01	.28	3.50	—	Herring, Atlantic
—	—	—	—	—	—	—	—	Herring, kippered
—	—	—	—	—	—	—	—	Herring, pickled
.04	.04	2.0	84	.05	.16	3.50	0	Herring, smoked
.06	.28	.8	—	.15	.18	—	—	Lobster, fresh
.06	.28	.8	—	.15	.18	—	—	Lobster, canned
.01	.26	1.1	175	.10	.65	6.30	—	Mackerel, Atlantic
—	—	—	—	—	—	—	—	Mackerel, salt
.07	.17	7.1	210	.18	.22	1.20	3	Oysters
.02	.22	1.0	—	—	.07	1.70	—	Perch, fresh, white
—	—	.7	—	—	—	—	—	Pickerel
.02	.22	1.0	—	.09	.07	1.70	—	Pike, common
.02	.24	1.0	285	.13	.20	6.70	—	Salmon, Atlantic
.01	.24	1.0	285	.21	.20	7.10	9	Salmon, Chinook
.07	.29	.9	290	.02	.16	7.82	—	Salmon, canned
.04	.37	1.8	150	.05	.35	3.50	—	Sardines, canned
.12	.04	3.0	0	—	—	1.40	—	Scallops
.02	.22	1.0	125	.09	.15	—	—	Shad
.02	.24	1.2	2000	1.00	.10	2.36	5	Shad roe
.08	.15	1.2	60	.09	.03	1.10	—	Shrimp, canned
.02	.20	1.0	—	—	.13	—	—	Smelts
.02	.16	1.2	—	—	—	—	—	Sturgeon
—	—	—	—	—	—	—	—	Terrapin
.02	.22	1.1	12	.09	.05	3.50	—	Trout, brook
.03	.28	1.3	200	.04	.14	10.20	—	Tuna fish, canned
.02	.23	1.1	—	—	—	—	—	Turtle, green
.05	.26	.7	—	.09	—	—	—	Whitefish

	Approximate Measure	Water	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Calories
		Gm.	Gm.	Gm.	Gm.	Gm.	
Cooked Fish							
Boiled or steamed medium fat to lean	large serving	75	21.0	2.0	0	0	102
Boiled or steamed, fatter fish	large serving	65	21.5	11.0	0	0	185
Baked or broiled	large serving	60	24.0	12.5	0	0	208
Fried in meal, flour, or batter	large serving	60	19.5	11.5	7	0	210
Fruits							
Apples							
Fresh	1 small 2" diam	84	.3	.4	15	1.0	65
Canned, Unsweetened	½ cup	88	.2	.2	11	.6	47
Applesauce							
Sweetened	½ cup	80	.2	.1	20	.6	82
Apricots							
Fresh	2 – 3 medium	85	1.0	.1	13	.6	57
Canned	6 halves						
Water pack	3 Tbsp. juice	91	.5	.1	8	.3	35
In syrup		77	.6	.1	21	.4	87
Dried	28 halves	24	5.2	.4	67	3.2	292
Dried, cooked	6 – 7 halves	67	1.3	.0	31	.7	129
Avocado	½ of 4" pear	67	1.7	26.4	5	1.2	264
Banana	1 medium 6" long	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Blackberries							
Fresh	⅔ cup	85	1.2	1.1	12	4.1	63
Canned							
Water pack	½ cup	89	.9	.7	9	2.0	46
Juice pack	½ cup	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]
In syrup	½ cup	79	.7	.7	19	2.5	85
Blueberries							
Fresh	⅔ cup	83	.6	.6	15	1.2	68
Canned							
Water pack	½ cup	90	.4	.4	9	1.0	41
Juice pack	½ cup	88	.4	.4	11	1.0	49
In syrup	½ cup	73	.4	.4	26	1.0	109
Cantaloupe	¼ melon; ⅔ cup diced	93	.6	.2	5	.5	24
Cherries							
Fresh, sour	⅔ cup	84	1.3	.5	13	.4	62
sweet	15 cherries	83	1.1	.5	15	.4	69

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Cooked Fish
—	—	—	—	—	—	—	—	Boiled or steamed medium fat to lean
—	—	—	—	—	—	—	—	Boiled or steamed fatter fish
—	—	—	—	—	—	—	—	Baked or broiled
—	—	—	—	—	—	—	—	Fried in meal, flour, or batter
								Fruits
								Apples
.01	.01	.3	80	.02	.02	.09	5	Fresh
								Canned
.01	.01	.3	46	.01	.01	.04	1	Unsweetened
								Applesauce
.00	.01	.3	50	.01	.01	.04	1	Sweetened
								Apricots
.02	.02	.5	2500	.04	.06	.71	7	Fresh
								Canned
.01	.02	.3	2400	.02	.02	.33	4	Water pack
.01	.02	.3	2400	.02	.02	.33	4	In syrup
.07	.12	7.6	4800	.08	.19	.98	10	Dried
.02	.03	2.1	2000	.02	.05	.25	2	Dried, cooked
.02	.04	1.4	125	.09	.09	.97	10	Avocado
.01	.03	.6	350	.04	.07	.57	10	Banana
								Blackberries
.02	.02	.9	90	.03	—	.31	10	Fresh
								Canned
.01	.01	.6	50	.01	.03	.18	3	Water pack / Juice pack / In syrup
								Blueberries
.02	.01	.8	100	.04	.02	.31	15	Fresh
								Canned
.01	.01	.5	70	.02	.01	.18	5	Water pack / Juice pack / In syrup
.02	.02	.4	2400	.05	.05	.05	35	Cantaloupe
								Cherries
.02	.03	.4	800	.05	.06	.14	4	Fresh, sour
.02	.02	.5	1300	.05	.06	.14	8	Fresh, sweet

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					total	fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Cherries (Cont'd)							
Candied	35 medium	12	.5	.2	87	.5	352
Canned							
Water pack	½ cup	89	.6	.2	10	—	44
Juice pack	½ cup	86	.8	.4	13	—	59
In syrup, red	½ cup	70	.6	.1	29	.2	119
In syrup, white	½ cup	78	.6	.1	21	.2	87
Citron, candied	1⅓ cup sliced	18	.2	.3	80	1.4	324
Cranberries							
Fresh	1 cup	87	.4	.7	11	1.4	52
Sauce, canned	½ cup	48	.1	.3	51	.4	207
Currants							
Fresh	1 cup scant	85	1.6	.4	13	3.2	62
Dried	½ cup	24	2.3	.5	71	2.4	298
Dates	14 – 15 stoned	20	2.2	.6	75	2.4	314
Figs							
Fresh	3–4 small	78	1.4	.4	20	1.7	89
Dried	6 medium	24	4.0	1.2	68	5.8	299
Gooseberries, fresh	⅔ cup	88	.8	.4	10	2.5	47
Grapefruit							
Fresh	½ medium, 4″ diam.	89	.5	.2	10	.3	44
Canned, juice pack	½ cup	90	.5	.2	9	.2	40
Grapes, American	½ cup; 20 - 25 grapes	82	1.4	1.4	15	.5	78
Grapes, European	½ cup; 15 - 20 grapes	82	.8	.4	17	.5	74
Guavas, common	2 small	81	1.0	.6	17	5.5	78
Honeydew melon	¼ of 5″ melon	91	.6	.2	8	.5	36
Kumquat	6 medium	81	.9	.1	17	3.7	73
Loganberries							
Fresh	¾ cup	83	1.0	.6	15	1.4	69
Canned							
Water pack	½ cup	87	1.0	.6	11	1.9	53
Juice pack	½ cup	86	1.0	.1	13	2.0	57
Mangoes	½ medium, 3½″ long	81	.7	.2	17	1.0	73
Mulberries	⅔ cup	83	1.2	.6	15	2.0	70
Muskmelon—see Cantaloupe							
Nectarines	2 medium	83	.5	.1	16	.4	67

OF FOODS (*Continued*)
gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Cherries (Cont'd)
—	—	—	—	—	—	—	—	Candied
								Canned
								Water pack
								Juice pack
.01	.01	.3	870	.03	.02	.18	3	In syrup, red
			12					In syrup, white
.12	.03	—	—	—	—	—	—	Citron, candied
								Cranberries
.01	.01	.6	40	—	—	.13	12	Fresh
.01	.01	.3	10	—	—	—	5	Sauce, canned
								Currants
.04	.04	.9	120	.05	.14	—	35	Fresh
.08	.14	2.7	—	.10	—	—	—	Dried
.07	.06	2.1	180	.08	.05	2.18	0	Dates
								Figs
.05	.04	.8	75	.09	.08	.63	2	Fresh
.22	.10	2.9	60	.13	.11	1.72	0	Dried
.02	.03	.5	380	.15	—	—	25	Gooseberries, fresh
								Grapefruit
.02	.02	.3	10	.05	.02	.22	35	Fresh
.02	.02	.3	10	.04	.02	.22	30	Canned, juice pack
.02	.02	.7	40	.05	.02	—	3	Grapes, American
.02	.02	.6	50	.07	.06	.29	3	Grapes, European
.02	.02	.3	200	.04	.09	1.10	75	Guavas, common
.02	.02	.4	10	.05	—	.30	20	Honeydew melon
—	—	—	—	—	—	—	30	Kumquat
								Loganberries
.03	.02	2.1	—	.03	—	—	35	Fresh
								Canned
								Water pack
.02	.02	1.5	—	.03	—	—	25	Juice pack
.01	.02	.3	1000	.06	.05	—	25	Mangoes
—	—	—	—	—	—	—	—	Mulberries
								Muskmelon—see Cantaloupe
.01	.02	.5	1500	.07	—	—	8	Nectarines

TABLE I — COMPOSITION
(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					total	fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Olives							
Green pickled	12 medium, stoned	75	1.5	13.5	4	1.2	144
Ripe pickled	12 medium, stoned	73	1.6	19.0	3	1.9	189
Oranges, fresh	1 medium	87	.9	.2	11	.6	49
Papaws	1 medium	77	5.2	.9	17	—	97
Papayas	¼ 5″ diam.	89	.6	.1	10	.9	43
Peaches							
Fresh	1 medium	87	.5	.1	12	.6	51
Canned							
Water pack	2 halves; 1 Tbsp. juice	92	.5	.1	7	.3	31
Juice pack		90	.4	.2	9	.2	39
In syrup		81	.4	.1	18	.4	75
Dried	6 – 8 halves	24	3.0	.6	69	3.5	293
Pears							
Fresh	1 medium	83	.7	.4	16	1.4	70
Canned							
Water pack	2 halves, 1 Tbsp. juice	91	.3	.1	8	.7	34
Juice pack		87	.2	.1	12	.6	50
In syrup		81	.2	.1	18	.8	75
Dried	6 – 8 halves	24	2.3	.4	72	6.1	301
Persimmons, native	½, 3″ long	64	.8	.4	34	1.9	143
Pineapple							
Fresh	⅔ cup ½″ pcs.	85	.4	.2	14	.4	59
Canned							
Water pack	1 slice ¾″ thk.	86	.3	.1	13	.3	54
Juice pack		85	.4	.1	15	.4	63
In syrup		78	.4	.1	21	.3	87
Plums							
Fresh	3 medium	86	.7	.2	13	.5	57
Canned							
Juice pack	2 medium, 1 Tbsp. juice	80	.4	.1	19	.2	78
In syrup		79	.4	.1	20	.3	83
Pomegranates	1 medium, pulp	81	.6	.2	18	.3	76
Prunes, dried	10-12 medium, pitted	24	2.3	.6	71	1.6	299
Quinces	2 small	85	.3	.1	14	1.8	58
Raisins, seeded or seedless	1 cup	24	2.3	.5	71	—	298

OF FOODS (*Continued*)
gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Olives
.10	.02	2.0	200	.01	.30	—	0	Green pickled
.03	.02	2.0	125	.01	0	—	0	Ripe pickled
.02	.02	.4	250	.08	.03	.22	45	Oranges, fresh
—	—	—	—	—	—	—	36	Papaws
.02	.01	.3	2500	.02	.08	—	45	Papayas
								Peaches
.01	.02	.3	1200	.01	.04	.88	8	Fresh, yellow
								Canned
								Water pack
								Juice pack
.01	.01	.2	440	.01	.02	.64	4	In syrup
.06	.12	6.0	3400	.04	.15	1.89	2	Dried
								Pears
.01	.02	.3	50	.04	.05	.14	3	Fresh
								Canned
								Water pack
								Juice pack
.01	.02	.2	30	.01	.02	.13	2	In syrup
.03	.27	5.4	45	.07	.15	—	0	Dried
.02	.02	.3	2550	—	.25	—	43	Persimmons
								Pineapple
.02	.01	.3	200	.09	.04	.31	45	Fresh
								Canned
								Water pack
								Juice pack
.01	.01	.2	50	.07	.02	.18	5	In syrup
								Plums
.02	.02	.5	360	.05	.04	.55	5	Fresh
								Canned
								Juice pack
.01	.02	.3	220	.02	.03	.35	1	In syrup
.01	.01	.2	—	—	—	—	6	Pomegranates
.06	.09	2.9	2000	.09	.10	1.52	6	Prunes, dried
—	—	—	—	—	—	—	8	Quinces
.06	.11	3.0	100	.14	.10	.53	3	Raisins, seeded or seedless

TABLE I — COMPOSITION

(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate total	Carbohydrate fiber	Calories
		Gm.	Gm.	Gm.	Gm.	Gm.	
Raspberries							
Fresh, black	¾ cup	81	1.5	1.6	16	3.5	84
Fresh, red	¾ cup	83	1.1	.6	14	2.8	66
Canned	½ cup						
Water pack		88	.9	.9	10	2.5	52
Juice pack		85	.8	.6	13	2.4	61
In syrup		71	.6	.5	28	1.9	119
Rhubarb							
Fresh	⅞ cup 1″ pcs.	95	.5	.1	4	.7	19
Canned, water pack	½ cup	96	.4	.1	3	.8	18
Strawberries							
Fresh	½ cup – ¾ cup	90	.8	.6	8	1.2	41
Canned	½ cup						
Water pack		93	.6	.4	6	.9	30
Juice pack		90	.8	.8	8	.8	42
In syrup		71	.5	.2	28	.7	116
Tangerines	1 medium	87	.8	.3	11	1.0	50
Watermelon	½ cup cubed; ¼″ slice	92	.5	.2	7	.6	32
Meats							
Beef							
Chuck, lean, raw	about ¼ lb. A.P.	71	19.2	9.0	0	0	158
Chuck, medium, raw		65	18.6	16.0	0	0	218
Corned, lean	3 slices	63	18.4	13.0	0	0	191
Corned beef hash, canned	½ cup	71	12.8	5.5	9	.2	137
Dried, salted, smoked	18 slices, thin	52	30.0	6.5	0	0	180
Flank, lean, raw	about ¼ lb. A.P.	52	17.0	30.0	0	0	338
Flank, medium, raw		45	14.6	40.0	0	0	418
Heart, lean	3 slices	78	16.9	3.7	1	0	104
Kidney	⅓ medium	75	15.0	8.1	1	0	136
Liver, beef	3½″ x 4″ x ⅝″	69	19.7	3.2	6	0	132
Loin, lean, raw	about ¼ lb. A.P.	64	18.6	16.0	0	0	218
Loin, medium, raw		57	16.9	25.0	0	0	293
Pancreas, beef	1 large	60	13.5	25.0	0	0	279
Rib, lean, raw	about ¼ lb. A.P.	66	19.0	14.0	0	0	202
Rib, medium, raw		59	17.4	23.0	0	0	277
Roast, canned	5″ x 3¼″ x ½″	60	25.0	13.0	0	0	217

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Raspberries
.03	.03	1.0	140	.03	—	—	11	Fresh black
.04	.04	.9	150	.03	—	—	25	Fresh red
								Canned
								Water pack
								Juice pack
.02	.02	.5	100	.02	—	—	—	In syrup
								Rhubarb
.04	.02	.6	100	.01	—	.11	15	Fresh
.04	.03	.6	100	.01	—	—	2	Canned, water pack
								Strawberries
.03	.03	.8	50	.03	.03	.24	65	Fresh
								Canned
								Water pack
								Juice pack
—	—	—	—	—	—	—	18	In syrup
.04	.02	.3	350	.07	.02	.22	32	Tangerines
.01	.01	.2	540	.05	.07	.24	6	Watermelon
								Meats
								Beef
.01	.21	3.0	20	.13	.23	6.00	0	Chuck, lean, raw
.01	.20	3.0	—	.13	—	—	0	Chuck, medium, raw
.01	.20	4.1	40	.05	.10	1.66	0	Corned, lean
.01	.08	3.8	15	.03	.11	2.00	—	Corned beef hash, canned
.02	.32	4.5	—	.08	.31	6.48	0	Dried, salted, smoked
.01	.18	—	—	—	—	—	—	Flank, lean, raw
.01	.16	2.2	—	—	—	—	—	Flank, medium, raw
.01	.24	6.2	200	.68	.89	7.85	2	Heart, lean
.01	.26	6.5	1000	.25	2.10	7.40	11	Kidney
.01	.37	8.2	27500	.32	2.54	14.20	31	Liver
.01	.20	2.5	20	—	—	—	—	Loin, lean, raw
.01	.18	3.7	20	.20	.29	7.00	—	Loin, medium, raw
.01	—	6.0	—	.32	.59	4.50	—	Pancreas
.01	.21	2.4	—	—	.14	—	—	Rib, lean, raw
.01	.19	2.8	—	—	.13	—	—	Rib, medium, raw
.02	.27	4.9	—	.04	.17	7.20	—	Roast, canned

TABLE I — COMPOSITION

(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate: total	Carbohydrate: fiber	Calories
		Gm.	Gm.	Gm.	Gm.	Gm.	
Round, lean, raw	about $\frac{1}{4}$ lb. A.P.	71	19.7	8.0	0	0	151
Round, medium, raw		67	19.3	13.0	0	0	194
Rump, lean, raw	about $\frac{1}{4}$ lb. A.P.	60	17.4	22.0	0	0	268
Rump, medium, raw		53	15.5	31.0	0	0	341
Sirloin, roast	2 slices, 4″ x 3″ x $\frac{1}{4}$″	—	26.8	12.3	0	0	218
Sirloin, steak	1 steak, small	—	21.0	21.7	0	0	280
Stew with potatoes, onions, carrots	$\frac{1}{2}$ cup		6.6	4.8	10	—	111
Tongue, medium fat, fresh	6 slices	68	16.4	15.0	0	0	202
Tongue, canned or pickled	6 slices	57	19.3	20.3	0	0	261
Tongue, potted	$\frac{1}{2}$ cup	53	18.6	23.0	1	0	285
Tripe, commercial	$3\frac{1}{2}$ ounces	79	19.1	2.0	0	0	94
Tripe, pickled	1 cup	87	11.8	1.3	0	0	59
Lamb and Mutton							
Brains	$\frac{1}{3}$ set	79	10.5	8.3	1	0	121
Heart	3 slices 4″ x 4″ x $\frac{1}{4}$″	72	16.8	9.6	1	0	158
Leg, lean, raw	about $\frac{1}{4}$ lb. A.P.	71	18.4	9.1	0	0	156
Leg, medium, raw		64	18.0	17.5	0	0	230
Liver	3″ x 3″ x $\frac{5}{8}$″	71	21.0	3.9	3	0	131
Rib or chop, lean, raw	2 medium chops	65	17.7	15.6	0	0	211
Rib, medium, raw		52	14.9	32.4	0	0	351
Rib chop, broiled	2 medium chops	—	21.8	16.6	0	0	236
Shoulder, lean, raw	about $\frac{1}{4}$ lb. A.P.	67	16.7	14.7	0	0	199
Shoulder, medium, raw		58	15.6	25.3	0	0	290
Tongue		70	13.9	15.3	1	0	197
Pork, Cured							
Bacon, uncooked	7 slices	20	9.1	65.0	1	0	626
Bacon, broiled, drained, crisp	25 slices	13	25.0	55.0	1	0	599
Bacon, Canadian or very lean ham	4 – 5 slices	56	22.1	15.0	0	0	225
Ham, lean	about $\frac{1}{4}$ lb. A.P.	49	19.5	25.0	0	0	304
Ham, medium fat		42	16.9	35.0	0	0	384

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.01	.20	3.0	30	.05	.23	7.50	—	Round, lean, raw
.01	.21	3.0	—	—	—	—	—	Round, medium, raw
.01	.19	2.0	—	—	—	—	—	Rump, lean, raw
.01	.17	2.0	—	—	—	—	—	Rump, medium, raw
.02	.28	5.3	—	.05	.25	4.30	—	Sirloin, roast
.01	.23	3.5	30	.12	.21	5.46	—	Sirloin steak
.01	.06	2.5	—	—	—	—	—	Stew with potatoes, onions, carrots
.03	.12	6.9	—	.28	.22	6.12	—	Tongue, medium fat, fresh
.03	.20	3.0	—	.15	—	6.00	—	Tongue, canned or pickled
.01	.20	2.9	—	—	—	—	—	Tongue, potted
.01	.13	1.6	—	.01	—	—	—	Tripe, commercial
.01	.13	1.6	—	.01	—	3.00	—	Tripe, pickled
								Lamb and Mutton
.01	.11	—	—	.10	—	—	—	Brains
.01	.18	—	1000	.30	2.00	6.50	—	Heart
.01	.20	1.5	—	.30	.32	8.48	—	Leg, lean, raw
.01	.19	1.5	—	.20	.30	6.30	—	Leg, medium, raw
.01	.22	5.5	27000	.40	3.30	16.10	37	Liver
.01	.19	1.5	—	.25	.28	—	—	Rib or chop, lean, raw
.01	.16	1.2	—	.25	.33	5.80	—	Rib, medium, raw
.01	.23	3.4	—	.15	.21	7.54	—	Rib chop, broiled
.01	.18	1.6	—	.25	.33	5.80	—	Shoulder, lean, raw
.01	.17	—	—	—	—	—	—	Shoulder, medium, raw
.01	.15	—	—	—	—	—	—	Tongue
								Pork, Cured
.01	.11	1.5	0	.10	.10	4.40	0	Bacon, uncooked
.02	.27	3.0	0	.09	.13	—	0	Bacon, broiled, drained, crisp
.03	.24	2.3	—	1.00	.25	8.20	—	Bacon, Canadian
.02	.21	1.4	—	1.09	.25	—	—	Ham, lean
.02	.18	2.5	—	.66	.21	3.30	—	Ham, medium fat

	Approximate Measure	Water Gm.	Protein Gm.	Fat Gm.	Carbohydrate Total Gm.	Carbohydrate Fiber Gm.	Calories
Ham, devilled, canned	$\frac{1}{2}$ cup	31	19.0	43.0	0	0	463
Pigs' feet, pickled	average serving	67	16.7	14.8	0	0	200
Shoulder, smoked, lean	about $\frac{1}{4}$ lb. A.P.	42	16.9	35.0	0	0	384
Shoulder, smoked, medium fat	about $\frac{1}{4}$ lb. A.P.	36	14.6	44.0	0	0	456
Salt pork, medium	3″ square	14	6.2	76.0	0	0	709
Salt pork, fat	3″ square	8	4.0	85.2	0	0	783
Pork, Fresh							
Ham, lean, raw	about $\frac{1}{4}$ lb. A.P.	60	17.2	22.0	0	0	267
Ham, medium		53	15.2	31.0	0	0	340
Heart	1 medium	77	16.9	4.8	0	0	111
Liver	large serving	72	19.7	4.8	2	0	130
Loin, lean, raw	about $\frac{1}{4}$ lb. A.P.	63	17.9	18.0	0	0	234
Loin, medium, raw		58	16.4	25.0	0	0	291
Loin, chop, lean broiled	1 medium $\frac{1}{2}$″ thick	—	20.5	19.0	0	0	253
Picnic, lean, raw	about $\frac{1}{4}$ lb. A.P.	59	16.7	23.0	0	0	274
Picnic, medium, raw		52	14.8	32.0	0	0	347
Roast, lean, cooked	large serving	—	29.7	5.6	0	0	169
Shoulder butt, lean	about $\frac{1}{4}$ lb. A.P.	52	14.4	33.0	0	0	355
Shoulder butt, medium		45	12.5	42.0	0	0	428
Spareribs, lean	average serving	57	15.8	26.0	0	0	297
Spareribs, medium	average serving	53	14.6	32.0	0	0	346
Veal							
Brains	$\frac{1}{3}$ set	81	10.0	8.3	0	0	115
Heart		76	15.4	7.1	1	0	130
Liver	$3\frac{1}{2}$″ x 4″ x $\frac{5}{8}$″	71	19.0	4.9	4	0	136
Loin or chop, lean	about $\frac{1}{4}$ lb. A.P	71	19.7	8.0	0	0	151
Loin or chop, medium		69	19.2	11.0	0	0	176
Quarter, fore, lean		71	19.7	8.0	0	0	151
Quarter, fore, medium		68	19.1	12.0	0	0	184
Quarter, hind, lean		71	19.7	8.0	0	0	151
Quarter, hind, medium		68	19.1	12.0	0	0	184

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.01	.21	3.0	—	.48	.15	4.12	—	Ham, devilled
—	—	—	—	—	—	—	—	Pigs' feet, pickled
.01	.18	2.5	—	1.00	.28	3.83	—	Shoulder, smoked, lean
.02	.16	2.2	—	.74	.27	5.15	—	Shoulder, smoked, medium fat
.00	.07	.9	0	.05	.07	0	0	Salt pork, medium
.00	.04	.6	0	.04	.06	0	0	Salt pork, fat
								Pork, Fresh
.02	.19	2.3	—	1.18	.27	8.00	—	Ham, lean, raw
.02	.16	2.3	—	1.18	.27	5.53	—	Ham, medium
.01	.18	—	—	.60	.90	6.70	4	Heart
.01	.21	—	27000	.43	2.70	15.50	27	Liver
.02	.19	2.6	0	1.20	.24	5.70	—	Loin, lean, raw
.02	.18	2.5	0	1.20	.23	5.22	—	Loin, medium, raw
.01	.21	2.9	0	.88	—	4.45	—	Loin chop, lean, broiled
.01	.18	2.5	0	.71	.30	4.07	—	Picnic, lean, raw
.01	.16	2.0	0	—	—	—	—	Picnic, medium, raw
.02	.32	5.5	0	1.05	.35	4.10	—	Roast, lean, cooked
.01	.16	2.0	—	1.05	—	—	—	Shoulder butt, lean
.01	.14	1.8	—	—	—	—	—	Shoulder butt, medium
.01	.17	2.3	—	—	—	—	—	Spareribs, lean
.01	.16	2.2	—	1.13	1.22	3.48	—	Spareribs, medium
								Veal
.01	.36	1.5	—	—	—	4.50	—	Brains
.01	.24	6.2	—	.60	—	10.60	—	Heart
.01	.21	5.4	27000	.40	3.30	12.00	32	Liver
.01	.21	2.5	—	—	—	6.00	—	Loin or chop, lean
.01	.22	2.4	—	—	—	—	—	Loin, medium
.01	.21	2.3	—	—	—	—	—	Quarter, fore, lean
.01	.21	2.2	—	—	—	—	—	Quarter, fore, medium
.01	.21	2.7	—	.35	.29	8.00	—	Quarter, hind, lean
.01	.21	2.6	—	—	—	—	—	Quarter, hind, medium

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					total	fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Roast, lean, cooked	3″ x 2¾″ x ⅛″	—	32.2	11.3	0	0	231
Rib or cutlet, lean	about ¼ lb. A.P.	70	19.5	9.0	0	0	159
Rib, medium, raw		66	18.8	14.0	0	0	201
Round with rump, lean		73	19.9	6.0	0	0	134
Round with rump, medium		70	19.5	9.0	0	0	159
Sweetbreads	½ of 1 sweetbread	75	19.6	3.1	0	0	106
Tongue	6 slices	74	18.5	5.3	1	0	125
Poultry and Game							
Chicken							
Canned, meat only	3½ ounces	62	29.8	8.0	0	0	191
Dark meat	3 slices 3½″ x 2½″ x ¼″	73	21.0	4.7	0	0	126
White meat	3½″ x 2½″ x ¼″, 3 slices	73	23.3	3.2	0	0	122
Squabs, total E.P.	1 small bird	75	21.6	2.7	0	0	111
Fryers, 2½ to 3½ lb. live		68	20.0	11.0	0	0	179
Hens and cocks, mature		56	18.0	25.0	0	0	297
Roasters	½ breast or 1 thigh	66	20.2	12.6	0	0	194
Gizzard		71	23.1	3.8	1	0	131
Liver		70	22.1	4.0	3	0	136
Potted	½ cup	58	18.8	2.6	0	0	244
Duck, domestic, total E.P.	average serving	54	16.0	28.6	0	0	321
Goose, total E.P.	3″ x 3″ x ¼″	51	16.4	31.5	0	0	349
Goose liver	½ cup	67	16.5	10.0	5	0	176
Guinea hen, total E.P.		69	23.1	6.4	0	0	150
Opossum	large serving	46	13.0	40.0	0	0	412
Pheasant, total E.P.	½ breast or 1 thigh	69	24.3	5.2	1	0	144
Quail	1 small bird, E.P.	66	25.0	6.8	0	0	161
Rabbit, domestic		68	20.8	10.2	0	0	175
Rabbit, wild		73	21.0	5.0	0	0	129
Turkey, total E.P.		58	20.1	20.2	0	0	262

OF FOODS (*Continued*)

gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.02	.29	3.6	—	.24	.26	7.60	—	Roast, lean, cooked
.01	.21	2.5	—	—	—	—	—	Rib or cutlet, lean
.01	.18	2.3	—	—	—	—	—	Rib, medium, raw
.01	.21	2.5	—	—	—	—	—	Round with rump, lean
.01	.21	2.4	—	—	—	—	—	Round with rump, medium
.01	—	1.6	—	.06	.27	4.10	—	Sweetbreads
.01	.20	2.9	—	—	—	—	—	Tongue
								Poultry and Game
								Chicken
.02	.22	3.2	5	.01	.16	4.84	2	Canned, meat only
.01	.23	1.0	0	.15	.25	7.30	3	Dark meat
.01	.25	.7	0	.08	.06	6.10	1	White meat
.01	.23	3.0	0	.23	.15	6.00	—	Squabs
.01	.22	3.0	0	—	—	—	—	Fryers
.01	.19	—	0	—	—	—	—	Hens and cocks
.01	.22	3.0	0	.10	.20	6.70	—	Roasters
.02	.25	—	—	—	.27	—	6	Gizzard
.02	.24	—	24000	.40	2.50	14.60	35	Liver
.01	.20	—	—	—	—	—	—	Potted
.01	.17	2.4	—	.13	.41	7.89	8	Duck, domestic
.01	.18	2.0	—	.16	.24	—	13	Goose
.01	.18	—	—	.03	—	3.60	—	Goose liver
.02	.25	3.5	—	—	—	—	—	Guinea hen
—	—	—	—	—	—	—	—	Opossum
.02	.26	3.7	—	—	—	—	—	Pheasant
.02	.27	3.8	—	—	—	—	—	Quail
.01	.22	3.1	—	.05	.06	12.70	4	Rabbit, domestic
.01	.23	3.2	—	.05	.06	12.70	—	Rabbit, wild
.02	.35	4.9	—	.13	.24	7.90	—	Turkey

TABLE I — COMPOSITION

(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					total	fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Turkey, cooked, dark	2 slices 3″ x 3″ x ¼″	—	39.2	4.3	0	0	196
Turkey, cooked, light	2 slices 3″ x 3″ x ¼″	—	34.6	4.9	0	0	183
Venison, lean, raw		73	20.0	6.0	0	0	134
Sausage							
Beef and pork, fresh link	3½ ounces	45	11.3	41.2	0	0	416
Blood sausage and pudding	3½ ounces	47	14.8	34.6	0	0	371
Bologna, all meat	3 slices 2⅛″ diam. x 1/16″	64	14.4	17.8	0	0	218
Bologna, added cereal	3 slices	62	14.8	15.9	4	0	218
Country sausage, raw	1 cake 2½″ diam., ⅞″ thick	52	16.2	27.4	0	0	311
Frankfurt, all meat	1⅓ average	61	14.1	20.8	0	0	244
Frankfurt, cereal added	1⅓ average	64	15.2	14.1	3	0	200
Head cheese		62	15.0	20.3	0	0	243
Liver sausage and pudding	3 slices ¼″ thick	59	16.7	20.6	2	0	260
Luncheon roll	large serving	56	15.9	23.8	0	0	278
Sausage, Polish style	3½ ounces	56	16.4	23.1	0	0	274
Pork, pure, raw	3 links 4″ long	42	10.8	44.8	0	0	446
Salami	3 slices 2⅛″ diam., ⅙″ thick	31	23.9	36.8	0	0	427
Souse	3½ ounces	73	13.2	12.3	0	0	164
Summer, dried	3½ ounces	30	24.5	37.3	0	0	434
Summer, semi-dried	3½ ounces	52	18.9	23.8	0	0	290
Summer, all types	3½ ounces	34	23.5	34.9	0	0	408
Meats, Cooked, Average							
Lean, dry		59	34.0	6.0	0	0	190
Lean, medium done		63	30.0	6.0	0	0	174
Lean, rare		66	27.0	6.0	0	0	162
Medium fat, dry		51	30.0	18.0	0	0	282

gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.02	.42	5.9	—	.11	.21	4.20	—	Turkey, cooked, dark
.02	.37	5.2	—	.07	.06	5.76	—	Turkey, cooked, light
.01	.22	3.0	—	—	—	—	—	Venison, lean
								Sausage
.01	.12	1.3	—	.09	—	—	—	Beef and pork link
.01	.16	2.1	—	—	—	—	—	Blood sausage and pudding
.01	.16	2.2	—	.32	.25	3.30	—	Bologna, all meat
.01	.16	2.2	—	—	—	—	—	Bologna, added cereal
.01	.18	2.4	—	.05	—	—	—	Country sausage
.01	.16	2.5	40	.48	.32	5.18	—	Frankfurt, all meat
.01	.16	2.3	—	.20	.25	2.49	—	Frankfurt, cereal added
.01	.16	2.1	—	.06	.12	1.07	—	Head cheese
.01	.18	2.5	10000	.19	1.30	5.20	—	Liver sausage and pudding
.01	.17	2.2	—	.30	.21	2.67	—	Luncheon roll
.01	.18	2.3	—	.28	—	—	—	Sausage, Polish
.01	.12	1.6	—	.26	.15	3.35	—	Pork, pure, raw
.01	.26	3.6	—	.24	.21	2.91	—	Salami
.01	.14	2.0	—	—	—	—	—	Souse
.01	.26	—	—	—	—	—	—	Summer, dried
.01	.20	—	—	—	—	—	—	Summer, semi-dried
.01	.25	3.5	—	.21	.23	3.11	—	Summer, all types
								Meats, Cooked, Average
.02	.37	5.1	—	—	—	—	—	Lean, dry
.02	.32	4.5	—	—	—	—	—	Lean, medium done
.02	.29	4.1	—	—	—	—	—	Lean, rare
.02	.32	4.5	—	—	—	—	—	Medium fat, dry

TABLE I — COMPOSITION

(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate: Total	Carbohydrate: Fiber	Calories
		Gm.	Gm.	Gm.	Gm.	Gm.	
Meats, cooked							
Medium fat, medium done		54	27.0	18.0	0	0	270
Medium fat, rare		58	23.0	18.0	0	0	254
Fat, medium done		47	22.0	30.0	0	0	358
Nuts							
Almonds, dried, unblanched	⅞ cup	5	18.6	54.1	20	2.7	641
Beechnuts		4	20.0	57.4	15	2.0	657
Brazilnuts	15 nuts shelled	5	14.4	65.9	11	2.1	695
Butternuts	16 – 20 nuts	4	23.7	61.2	8	—	678
Cashewnuts, roasted	¾ cup	4	19.6	47.2	26	1.0	607
Chestnuts, fresh	17 nuts	53	2.8	1.5	42	1.1	193
Chestnuts, dried		8	6.7	4.1	79	2.5	380
Cocoanut, fresh	1⅛ cup grated	47	3.4	34.7	14	3.2	382
Cocoanut, dried, sweetened, shredded	1⅛ cup grated	3	3.6	39.1	53	4.1	578
Hazelnuts (Filberts)	½ cup	6	12.7	60.9	18	3.4	671
Hickorynuts	½ cup	4	13.9	67.4	13	2.2	714
Peanut butter	6 tablespoons	2	26.1	47.8	21	2.0	619
Peanuts, roasted	¾ cup shelled	3	26.9	44.2	24	2.4	601
Pecans	⅞ cup	3	9.4	73.0	13	2.2	747
Pistachio nuts	¾ cup	6	19.6	53.2	19	2.2	633
Walnuts, black	1¼ cups scant	3	18.3	58.2	19	1.9	673
Walnuts, English	1¼ cups scant	3	15.0	64.4	16	2.1	702
Soups, Canned	(Can contents diluted with an equal volume of water)						
Bean	½ cup scant	84	3.4	1.4	9	—	63
Bouillon and consommé	½ cup scant	95	(1.0)	—	0	0	4
Clam chowder	½ cup scant	92	1.5	1.4	5	—	39
Mulligatawney	½ cup scant	89	3.7	.1	6	—	40
Pea	½ cup scant	92	1.6	.9	5	—	35
Tomato	½ cup scant	92	.9	1.0	6	—	37
Vegetable with beef or chicken	½ cup scant	91	3.3	1.1	4	—	39
Sugars, Syrups, and Sweets							
Dextrimaltose	6 tablespoons	—	—	—	88	0	352
Dextrose or glucose	10 tablespoons	—	—	—	100	0	400

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Meats, cooked
.02	.29	4.1	—	—	—	—	—	Medium fat, medium done
.01	.25	3.5	—	—	—	—	—	Medium fat, rare
.01	.24	3.3	—	—	—	—	—	Fat, medium done
								Nuts
.25	.48	4.4	75	.23	.30	1.82	8	Almonds, dried, unblanched
—	—	—	—	—	—	—	—	Beechnuts
.12	.60	2.8	10	.50	—	—	—	Brazilnuts
—	—	6.8	—	—	—	—	—	Butternuts
.05	.48	—	—	.16	.20	—	—	Cashewnuts
.03	.09	.7	80	.23	—	1.17	6	Chestnuts, fresh
.03	.09	.8	—	—	—	—	—	Chestnuts, dried
.02	.10	2.7	—	.09	—	.40	2	Cocoanut, fresh
.04	.19	5.0	—	.03	—	.40	1	Cocoanut, dried, sweetened
.29	.35	4.1	100	.40	—	—	3	Hazelnuts
—	—	2.4	—	.54	—	—	—	Hickorynuts
.07	.39	1.9	—	.19	.13	16.20	—	Peanut butter
.07	.40	2.0	0	.40	.13	16.00	0	Peanuts, roasted
.10	.34	2.6	300	.50	.30	—	0	Pecans
—	—	7.9	200	—	—	—	0	Pistachio nuts
—	—	6.0	70	.33	—	—	0	Walnuts, black
.09	.38	2.1	50	.45	—	—	0	Walnuts, English
								Soups, Canned
.05	.06	1.1	—	—	—	—	0	Bean
—	—	—	—	—	—	—	0	Bouillon, consommé
—	—	—	—	—	—	—	0	Clam chowder
—	—	—	—	—	—	—	0	Mulligatawney
—	—	—	—	—	—	—	0	Pea
—	—	—	—	—	—	—	—	Tomato
—	—	—	—	—	—	—	—	Vegetable with beef or chicken
								Sugars, Syrups, and Sweets
0	0	0	0	0	0	0	0	Dextrimaltose
0	0	0	0	0	0	0	0	Dextrose or glucose

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					total	fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Sugar, brown	⅝ cup	3	0	0	96	0	384
Sugar, maple		8	0	0	90	0	360
Sugar, granulated, loaf, powdered	½ cup scant	0	0	0	100	0	400
Corn syrup	⅜ cup	5	0	0	74	0	296
Honey, strained	5 tablespoons	20	.3	0	80	0	321
Maple syrup	5 tablespoons	34	0	0	64	0	256
Molasses, cane, med.	5 tablespoons	24	2.4	0	60	0	250
Sorghum	5 tablespoons	23	0	0	67	0	268
Jam, commercial	¼ cup	36	.5	.3	63	.6	254
Jellies	5 tablespoons	35	.2	.0	65	0	261
Marmalade, orange	5 tablespoons	28	.9	.4	70	.6	287
Caramels	10 pieces	7	2.0	12.0	78	0	428
Chocolate, milk	3½ ounces	1	6.0	33.5	54	0	542
Chocolate creams	7 pieces	9	4.0	14.0	72	0	430
Fudge, chocolate	6 pieces 1″ square	25	1.3	8.3	65	0	340
Hard candy	15 pieces	1	0	0	99	0	396
Marshmallows	14	15	3.0	0	81	0	336
Peanut brittle	4 pieces 2½″ square ⅜″ thick	2	12.0	18.0	67	0	478
Vegetables							
Artichokes, globe or French	½ of 1 (3″ diam.)	84	2.9	.4	12	3.2	63
Artichoke, Jerusalem	2 medium	80	2.2	.1	17	.8	78
Asparagus							
Fresh	12 stalks 5″	93	2.2	.2	4	.7	27
Canned	7 stalks	94	1.6	.2	3	.5	20
Beans, kidney, canned	½ cup	76	5.7	.4	16	.9	90
Beans, Lima							
Fresh	½ cup	67	7.5	.8	24	1.5	133
Canned, baby	½ – ⅔ cup	80	5.1	.4	13	1.0	76
Dried	½ cup (2¼ cup cooked)	13	20.7	1.3	62	4.3	343
Beans, Navy, pea							
Dry	½ cup	11	22.0	1.5	62	3.9	350

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.08	.04	0	0	0	0	0	0	Sugar, brown
.11	.01	3.0	0	0	0	0	0	Sugar, maple
0	0	0	0	0	0	0	0	Sugar, granulated loaf powdered
.04	.01	.9	0	0	.01	.11	0	Corn syrup
.00	.02	.7	0	.01	.07	.11	2	Honey, strained
.16	.01	3.0	0	—	—	—	0	Maple syrup
.27	.03	6.7	0	.05	.20	.11	0	Molasses, medium
.15	.03	12.0	0	—	—	2.10	0	Sorghum
.02	.01	.3	10	.01	.02	.15	1	Jam, commercial
.01	.01	.3	10	.01	.02	.15	1	Jellies
.02	.01	.3	0	.02	.02	.07	8	Marmalade, orange
—	—	—	—	—	—	—	—	Caramels
.08	.40	2.2	—	—	—	—	—	Chocolate, sweet
.02	.10	.8	—	.04	.14	.56	—	Chocolate creams
.03	.06	.3	183	.02	.04	.33	—	Fudge, chocolate
0	0	0	0	0	0	0	0	Hard candy
0	0	0	0	0	0	0	0	Marshmallows
.01	.16	.8	110	.13	.09	4.70	0	Peanut brittle
								Vegetables
.04	.09	1.0	200	.08	.03	—	9	Artichokes, globe or French
.03	.03	.4	—	.06	—	—	7	Artichoke, Jerusalem
								Asparagus
.02	.04	.9	970	.19	.12	1.15	63	Fresh
.01	.03	.6	50	.05	.06	.75	15	Canned, white
.01	.03	.6	510	.07	.10	.86	15	Canned, green
.04	.14	1.5	—	.08	—	—	—	Beans, kidney, canned
								Beans, Lima
.06	.16	2.3	210	.22	.13	.95	35	Fresh
.02	.09	1.6	120	.04	.04	.53	7	Canned
.07	.38	7.5	100	.53	.14	1.39	0	Dry
								Beans, Navy, pea
.15	.46	10.3	0	.52	.34	2.00	0	Dry

TABLE I — COMPOSITION

(Values given for 100

	Approximate Measure	Water	Protein	Fat	Carbohydrate		Calories
					total	fiber	
		Gm.	Gm.	Gm.	Gm.	Gm.	
Beans (Continued)							
Canned, no pork	½ cup	74	6.0	.4	19	1.0	102
Beans, snap, green or wax							
Fresh	½ – ⅔ cup	89	2.4	.2	8	1.4	43
Canned	½ cup	94	1.0	.1	3	.6	17
Canned, strained	6 tablespoons	93	1.3	.1	5	.7	26
Beans, soy							
Fresh	⅔ cup shelled	67	12.5	6.5	(6)	1.5	132
Dry	½ cup	8	34.8	18.1	(12)	5.0	350
Sprouts, fresh	1 cup	82	2.9	.3	4	.9	30
Beets							
Fresh	½ – ⅝ cup diced	88	1.6	.1	10	.9	47
Canned	½ – ⅝ cup	86	1.5	.1	12	.9	55
Canned, strained	6 tablespoons	89	1.3	.1	9	.7	42
Beet greens	½ cup when cooked	90	2.0	.3	6	1.4	35
Broccoli	1 medium stalk	90	3.3	.2	6	1.3	39
Brussels sprouts	9 medium	85	4.4	.4	9	1.3	57
Cabbage	1 cup chopped raw ½ cup cooked	92	1.4	.2	5	1.0	29
Cabbage, Chinese	⅞ cup shredded	95	1.4	.1	2	.6	15
Carrots							
Fresh	1 large; ½ cup diced	88	1.2	.3	9	1.1	44
Canned, strained	6 tablespoons	92	.7	.1	7	.6	32
Cauliflower	¼ small head	92	2.4	.2	5	.9	31
Celeriac	4 – 6 roots	88	1.7	.3	9	1.4	46
Celery	4 stalks	94	1.3	.2	4	.7	23
Chard, leaves, stalks	½ cup when cooked	92	1.4	.2	4	.9	23
Collards	½ cup when cooked	87	3.9	.6	7	1.2	49
Corn							
Fresh	1 medium ear; ½ cup	74	3.7	1.2	21	.8	110
Canned	½ cup	76	2.5	.9	20	.4	98
Cucumber	14 slices ⅛″	96	.7	.1	3	.5	16
Dandelion greens	½ cup when cooked	86	2.7	.7	9	1.8	53
Dock	½ cup when cooked	93	2.1	.3	3	.8	23

OF FOODS (*Continued*)

gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Beans (Continued)
.06	.19	2.1	55	.13	.12	.88	—	Canned, no pork
								Beans, snap, green or wax
.07	.04	1.4	600	.08	.12	.49	21	Fresh
.04	.03	.9	310	.03	.03	.33	3	Canned
.05	.03	1.0	670	.04	.08	—	—	Canned, strained
								Beans, soy
.08	.22	.8	200	.50	.30	—	34	Fresh
.23	.59	8.4	100	1.20	.75	4.00	0	Dry
.04	.07	1.8	—	.08	.08	.53	15	Sprouts, fresh
								Beets
.03	.04	1.0	100	.02	.04	.40	12	Fresh
.02	.03	.7	10	.01	.02	.20	3	Canned
.01	.03	1.3	60	.02	.03	—	—	Canned, strained
.00*	.04	3.2	15000	.10	.30	.31	50	Beet greens
.13	.08	1.3	2540	.09	.24	.90	99	Broccoli
.03	.08	1.3	500	.13	.14	.29	120	Brussels sprouts
.05	.03	.5	40	.08	.05	.22	50	Cabbage
.05	.05	1.0	1400	.08	.05	—	45	Cabbage, Chinese
								Carrots
.04	.04	.8	10000	.06	.06	.55	5	Fresh
.03	.02	1.0	6500	.03	.04	—	4	Canned, strained
.02	.07	1.1	140	.12	.13	.57	75	Cauliflower
.05	.07	.8	—	—	—	—	—	Celeriac
.05	.05	.5	0	.04	.04	.22	9	Celery, bleached
			1000					Green
0*	.04	4.0	8400	.05	.12	.22	30	Chard, leaves, stalks
.25	.06	1.6	6200	.20	.25	.31	60	Collards
								Corn
.01	.10	.5	240	.14	.12	1.70	12	Fresh
.01	.07	.3	30	.02	.04	.88	4	Canned
.01	.02	.3	200	.04	.05	.18	10	Cucumber
0*	.04	3.0	12000	.19	.23	—	100	Dandelion greens
—	—	1.4	14000	.08	—	—	165	Dock

* Calcium not nutritionally available.

	Approximate Measure	Water Gm.	Protein Gm.	Fat Gm.	Carbohydrate total Gm.	Carbohydrate fiber Gm.	Calories
Eggplant	½ cup diced; 2 slices	93	1.1	.2	6	.9	30
Endive or chicory	½ large head	94	1.6	.2	4	.8	24
Escarole	4 large leaves	94	1.6	.2	4	.8	24
Kale	½ cup cooked	87	3.9	.6	7	1.2	49
Kohlrabi	½ – ⅔ cup diced	90	2.1	.1	7	1.1	38
Lambsquarters	½ cup when cooked	84	3.8	.7	8	2.6	54
Lentils, dry	⅔ cup scant	11	24.7	1.0	60	3.3	348
Lettuce							
Bleached, head	⅓ head; 6 leaves	95	1.2	.2	3	.6	19
Loose leaf, green	6 large leaves	95	1.2	.2	3	.6	19
Romaine	9 leaves 9″ long	95	1.0	.4	3	.6	20
Mushrooms	4 large; 10 small	91	—	.2	—	.9	2
Mustard greens	½ cup when cooked	92	2.3	.3	4	.8	28
Okra	½ cup diced	90	1.8	.2	7	1.0	37
Onions							
Green—scallions	10 – 5″ long	88	1.0	.2	11	1.8	50
Mature	2 – 3 small	88	1.4	.2	10	.8	49
Oyster plant or salsify	⅔ cup scant	79	3.5	1.0	16	1.8	87
Parsley	100 average sprigs	84	3.7	1.0	9	1.8	60
Parsnips	½ cup diced; 1 small	79	1.5	.5	18	2.2	83
Peas							
Fresh	¾ cup	74	6.7	.4	18	2.2	102
Canned, small	½ cup	85	3.3	.2	10	1.3	55
Canned, strained	6 tablespoons	86	4.0	.4	9	.7	56
Dry, split	½ cup	10	24.5	1.0	62	2.8	355
Peppers, green	1 large pod, empty	92	1.2	.2	6	1.4	31
Potatoes, white	1 small	78	2.0	.1	19	.4	85
Potato chips	3 cups	3	6.7	37.1	49	—	557
Pumpkin							
Fresh	½ cup mashed	91	1.2	.2	7	1.3	35
Canned	½ cup	90	1.0	.3	8	1.2	39
Radishes	10, 1″ diam.	94	1.2	.1	4	.7	22

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.02	.04	.4	100	.05	.04	.79	6	Eggplant
.07	.04	1.8	3600	.10	.20	.72	14	Endive or chicory
.07	.04	1.8	10000	.11	.25	.38	13	Escarole
.23	.06	2.2	10000	.19	.42	.51	125	Kale
.08	.06	.7	—	.05	—	.27	60	Kohlrabi
—	—	—	10000	—	—	—	—	Lambsquarters
.10	.37	8.3	50	.50	.32	3.10	0	Lentils, dry
								Lettuce
.02	.03	.5	200	.06	.04	.18	5	Bleached, head
.03	.04	1.1	5000	.08	.15	.05	15	Loose leaf, green
.06	.02	.9	1000	.08	.10	—	13	Romaine
.01	.10	.7	0	.11	.42	6.37	5	Mushrooms
.22	.07	5.6	10000	.10	.38	—	120	Mustard greens
.07	.06	.7	520	.12	.10	.70	25	Okra
								Onions
.03	.04	.5	5000	.03	.12	.11	35	Green
.03	.04	.5	0	.04	.02	.11	10	Mature
—	—	1.2	—	—	—	—	—	Oyster plant or salsify
.19	.08	3.2	18000	—	—	—	189	Parsley
.06	.08	.7	50	.11	.08	.31	15	Parsnips
								Peas
.02	.12	1.9	1000	.30	.18	1.76	30	Fresh
.01	.08	1.7	380	.12	.06	.90	9	Canned
.01	.07	1.8	1300	.13	.12	—	7	Strained
.07	.40	6.0	180	.65	.18	2.84	0	Dry, split
.01	.03	.4	510	.06	.04	.37	170	Peppers, green
.01	.05	.7	40	.11	.04	1.21	12	Potatoes, white
.02	.10	1.8	0	.11	—	—	—	Potato chips
								Pumpkin
.02	.04	.8	1200	.04	.05	.71	5	Fresh
.02	.04	.7	950	.02	.06	.55	3	Canned
.02	.03	1.0	25	.03	.04	.15	25	Radishes

TABLE I — COMPOSITION

(Values given for 100

	Approximate Measure	Water Gm.	Protein Gm.	Fat Gm.	Carbohydrate Total Gm.	Carbohydrate Fiber Gm.	Calories
Rutabagas	½ cup diced	89	1.1	.1	9	1.3	41
Sauerkraut	⅔ cup	93	1.1	.2	3	1.4	18
Spinach							
Fresh	½ cup cooked	93	2.3	.3	3	.6	24
Canned	½ cup	92	2.3	.5	4	.7	30
Canned, strained	6 tablespoons	94	2.0	.3	3	.6	23
Squash							
Summer	½ cup	95	.6	.1	4	.5	19
Winter	½ cup	89	1.5	.3	9	1.4	44
Sweet potatoes	1 small	69	1.8	.7	28	1.0	126
Tomatoes							
Green	1 small	95	1.2	.2	3	.4	19
Red, fresh	1 small, 2½″ diam.	94	1.0	.3	4	.6	23
Red, canned	½ cup	94	1.0	.2	4	.4	22
Purée, canned	½ cup	89	1.8	.5	7	.4	40
Turnips, white	½ cup diced	91	1.1	.2	7	1.1	34
Turnip greens	½ cup when cooked	90	2.9	.4	5	1.2	35
Water cress	35 medium sprigs	94	1.7	.3	3	.5	22
Yams	1 small	73	2.1	.2	24	.8	106
Miscellaneous							
Bouillon cubes	20 average	35	17.6	0	47	—	258
Catsup, tomato	6 tablespoons	70	2.0	.4	25	—	112
Codliver oil	9 tablespoons	0	0	100.0	0	0	900
Cucumber pickle,							
Dill	1 large	95	.5	.2	2	.4	12
Sweet	5 small	77	.4	.1	21	—	87
Gelatin, dry, plain	12 tablespoons	13	85.6	.1	0	0	343
Gelatin, sweetened	5 portions	2	9.4	0	89	0	394
Gravy, meat stock	7 tablespoons	86	.7	9.1	4	0	101
Yeast, dried, brewer's	10 tablespoons	11	50.0	1.6	37	—	362
Yeast, compressed	7 cakes	73	13.3	.4	13	—	110
Alcoholic Beverages				Alcohol			†
Ale, American	½ cup		.5	3.8	3.5		43
Beer, average	½ cup		.6	4.4	4.0		50
Brandy	3⅓ brandy glasses			35.0			250
Creme de Menthe	5 cordials			36.0	30.0		375

† Alcohol yields 7.1 calories per gram.

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
.06	.04	.4	25	.06	.08	.93	35	Rutabagas
.05	.03	.5	10	.03	.20	.22	3	Sauerkraut
								Spinach
0*	.06	3.0	9000	.10	.24	.68	62	Fresh
0*	.04	2.0	5200	.02	.08	.31	11	Canned
0*	.04	1.2	6000	.02	.11	—	9	Canned, strained
								Squash
.02	.02	.4	160	.05	.06	.72	13	Summer
.02	.03	.6	1170	.05	.06	.72	5	Winter
.04	.05	.7	7400	.11	.06	.62	23	Sweet potatoes
								Tomatoes
—	—	—	800	.07	.05	—	18	Green
.01	.02	.6	1130	.06	.04	.68	25	Red, fresh
.01	.02	.6	940	.05	.03	.68	17	Red, canned
.01	.03	1.1	1700	.09	.06	1.70	22	Purée, canned
.04	.03	.5	0	.03	.06	.84	30	Turnips, white
.25	.05	2.4	9000	.14	.53	.57	121	Turnip greens
.17	.04	2.6	4000	.10	.27	—	75	Water cress
.03	.05	.8	3000	.11	.09	.67	23	Yams
								Miscellaneous
.04	.51	4.2	0	.02	1.02	25.62	0	Bouillon cubes
.02	.04	1.0	270	.12	.07	2.40	10	Catsup, tomato
—	0	0	85000	0	0	0	0	Codliver oil
								Cucumber pickle,
.02	.03	.8	130	—	.03	—	5	Dill
.01	.02	.8	72	—	.03	—	5	Sweet
0	0	0	0	0	0	0	0	Gelatin, dry
0	0	0	0	0	0	0	0	Gelatin, sweetened
0	.01	.7	0	—	—	—	0	Gravy, meat stock
.08	1.89	20.0	0	16.30	4.00	40.00	0	Yeast, brewer's
.03	.61	4.9	0	.91	1.80	11.30	0	Yeast, compressed
								Alcoholic Beverages
.01	.02	.1		.00	.03	.79		Ale, American
				.01	.02	.84		Beer, average
								Brandy
								Creme de Menthe

* Calcium is nutritionally not available.

	Approximate Measure	Water	Protein	Fat	Carbohydrate total	Carbohydrate fiber	Calories
		Gm.	Gm.	Gm.	Gm.	Gm.	
				Alcohol			
Gin	2½ jiggers			40.0			284
Rum	2½ jiggers			43.9			312
Whiskey	2½ jiggers			42.2			301
Wine, California, red	1 wine glass		.2	10.0	.5		74
Wine, California, white	1 wine glass		.2	10.5	4.0		91
Wine, port	3 sherry glasses		.3	15.0	14.0		163

gram portions of food)

Minerals			Vitamins					
Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamine mg.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.	
								Gin
								Rum
								Whiskey
								Wine, California red
								Wine, California white
								Wine, port

TABLE II.—PROXIMATE COMPOSITION OF SOME COMMON FOODS *

Values per 100 Gm. of Food	C Gm.	P Gm.	F Gm.	Values for Common Portions	Weight Gm.	C Gm.	P Gm.	F Gm.
Bread								
Miscellaneous	51	9	2	1 slice	30	15	3	1
Rolls............	54	8	6	1 water-roll, large	50	27	4	3
				1 Parkerhouse	32	18	3	2
Cereal								
Cornflakes......				1 cup	20	15	2	—
Puffed rice......				1 cup	20	15	2	—
Shredded wheat .				1 biscuit	30	22	3	1
Cornmeal.......								
Farina.........								
Hominy........	77	11	2	⅔ cup cooked	20 dry	15	2	—
Macaroni.......								
Ralston........								
Rice...........								
Rolled oats.....								
Wheatena								
Crackers								
Graham.........	74	8	10	2 graham	17	13	1	2
Matzoth.........	70	15	—	1 matzoth	42	29	6	—
Saltines..........	71	9	12	3 saltines	10	7	1	1
Soda............	73	10	10	1 soda or	6	4	1	1
				1 Ry-Krisp				
Dairy Products								
Butter..........	—	1	81	1 teaspoon	5	—	—	4
Cheese								
Cream..........	2	7	37	1 ounce	30	1	2	11
American or Swiss	2	25	31	1 ounce	30	1	8	9
Cottage.........	4	19	1	2 tablespoons	40	2	8	—
Cream								
20 per cent.......	4	3	20	2 tablespoons	30	1	1	6
35 per cent.......	3	2	35	2 tablespoons	30	1	1	11
Milk								
Whole..........	5	3	4	1 cup	240	12	7	10
Evaporated......	10	7	8	½ cup	120	12	8	10
Skimmed........ (commercial)	5	3	—	1 cup	240	12	7	—
Buttermilk								
churned.....	5	3	1	1 cup	240	12	7	2
fermented....	5	3	4	1 cup	240	12	7	10
Dry milk								
Skimmed	52	36	1	2 tablespoons	15	8	5	—
whole.......	38	26	27	2 tablespoons	15	6	4	4
Malted.........	71	15	9	1 tablespoon	10	7	1	1

TABLE II.—PROXIMATE COMPOSITION OF SOME COMMON FOODS * (*Continued*)

Values per 100 Gm. of Food				Values for Common Portions				
	C Gm.	P Gm.	F Gm.		Weight Gm.	C Gm.	P Gm.	F Gm.
Eggs								
Whole	1	13	12	1 egg	50	—	7	6
Yolk	1	16	32	1 yolk	20	—	3	6
White	1	12	—	1 white	30	—	4	—
Fruits—See Classification of Fruits on page 721.								
6 per cent	6	1	—					
9 per cent	9	1	—					
12 per cent	12	1	—					
15 per cent	15	1	—					
18 per cent	18	1	—					
Fruits—Miscellaneous								
Dried, A.P.	69	3	1	4 prunes or 8 halves of apricots	30	21	1	—
Avocado, Mexican	7	2	23	½ pear	100	7	2	23
Banana, A.P.	15	1	—	1 medium	120	18	1	—
Banana, E.P.	23	1	—	1 medium	80	18	1	—
Dates	75	2	1	4 dates	30	22	1	—
Figs, dried	68	4	1	3 figs	35	24	1	—
Raisins	71	2	1	¼ cup	30	21	1	—
Meat, Fish, Chicken								
Lean meat **								
Beef round				2 ounces	60	—	18	4
Liver				3 ounces	90	—	27	5
Veal, loin	—	30	6	4 ounces	120	—	36	7
Sweetbreads								
Fowl								
Medium fat meat								
Beef, rib				2 ounces	60	—	16	11
Beef, sirloin				3 ounces	90	—	24	16
Beef, tenderloin	—	27	18					
Ham, lean								
Lamb chop								
Lamb leg								

** The figures used for meats are those for cooked products, medium done.

TABLE II.—PROXIMATE COMPOSITION OF SOME COMMON FOODS * (*Continued*)

Values per 100 Gm. of Food				Values for Common Portions				
	C Gm.	P Gm.	F Gm.		Weight Gm.	C Gm.	P Gm.	F Gm.
Fish								
Cooked or canned	—	23	7	2 ounces	60	—	14	4
				3 ounces	90	—	21	6
Oysters with liquor	4	6	1	4 medium	60	2	4	1
Shrimp	—	18	1	½ cup	100	—	18	1
Clams, Little Neck	4	7	—	6 small	40	2	3	—
Meat, miscellaneous								
Bacon, raw	—	9	65	1 strip, raw	20	—	2	13
Bacon				1 strip, cooked	10	—	2	7
Bacon				1 strip, crisp	6	—	2	4
Vegetables—See Classification of Vegetables on page 721.								
3 per cent	3	2	—					
6 per cent	6	2	—					
9 per cent	9	2	—					
15 per cent	15	2	—					
18 per cent	18	2	—					
Vegetables—Miscellaneous								
Beans, navy	62	22	2	½ cup baked	30 (dry) 100 (baked)	19	7	—
Beans, Lima, dry	62	21	1	½ cup cooked	30 (dry) 100 (baked)	19	6	—
Beans, Lima, fresh	24	8	1	½ cup	100	24	8	1
Corn, A.P.	8	1	—	1 ear, 6 inch	130	10	1	—
Corn, E.P.	21	4	—	½ cup	100	21	4	—
Mushrooms	—	—	—					
Olives, green	3	1	11	1 medium	10	—	—	1
Olives, ripe	3	1	16	1 medium	10	—	—	2
Potato, white A.P.	16	2	—	1 medium	150	24	3	—
Potato, white E.P.	19	2	—	1 medium	120	23	2	—
Potato, sweet A.P.	24	2	—	1 medium	150	36	3	—
Potato, sweet E.P.	28	2	—	1 medium	120	34	2	—
Soy beans, fresh	6	13	7	½ cup	100	6	13	7
Soy bean sprouts	6	9	2	¼ cup	50	3	5	1

TABLE II.—PROXIMATE COMPOSITION OF SOME COMMON FOODS * (*Continued*)

	Values per 100 Gm. of Food			Values for Common Portions				
	C Gm.	P Gm.	F Gm.		Weight Gm.	C Gm.	P Gm.	F Gm.
Nuts								
Almonds, E.P.	20	19	54	26 nuts, E.P.	30	6	6	16
Peanuts, E.P.	24	26	43	15 nuts	30	7	8	13
Pecans, E.P.	15	11	70	12 halves	30	5	3	21
Walnuts, English	16	15	64	8 - 15 nut meats	30	5	5	19
Miscellaneous								
Chocolate	18	6	53	1 square	30	5	2	16
Cocoa	29	8	24	1 teaspoon	2	1	—	—
Cornstarch	87	—	—	1 tablespoon	8	7	—	—
Flour	76	11	1	1 tablespoon	5	4	1	—
Gelatin	—	86	—	1 teaspoon	4	—	3	—
Honey	80	—	—	1 tablespoon	15	12	—	—
Karo	74	—	—	1 tablespoon	15	11	—	—
Marmalade, jam, jelly	65	—	—	1 tablespoon	20	13	—	—
Molasses	69	2	..	1 tablespoon	15	11	—	—
Mayonnaise	3	2	78	1 tablespoon	15	—	—	12
Oil	—	—	100	1 tablespoon	14	—	—	14
Yeast, compressed	13	13	—	1 cake	15	2	2	—
Yeast, brewer's	37	46	2	1 tablespoon	8	3	4	—

* The listings of food and style of presentation are based on "The Composition of a Few Common Foods" in *Manual of Diets*, Nutrition Department, Presbyterian Hospital, New York, 1943.

The food values are taken from: Chatfield, C. and Adams, G.: *Proximate Composition of American Food Materials*, Circular No. 549, Washington: Bureau of Home Economics, U. S. Department of Agriculture, 1940.

PORTIONS OF FRUIT

Amounts of fruit which will supply 10 Gm. of carbohydrate

55 Gm. of 18 per cent fruit contain 10 Gm. of carbohydrate
65 Gm. of 15 per cent fruit contain 10 Gm. of carbohydrate
85 Gm. of 12 per cent fruit contain 10 Gm. of carbohydrate
110 Gm. of 9 per cent fruit contain 10 Gm. of carbohydrate
165 Gm. of 6 per cent fruit contain 10 Gm. of carbohydrate

HOUSEHOLD MEASURES OF FRUIT

Amounts of fresh or unsweetened canned fruit which will supply 10 Gm. of carbohydrate

Apple	$\frac{1}{2}$ medium
Applesauce	$\frac{1}{3}$ cup
Apricots	2 medium
Apricots, dried	4-5 halves
Banana	$\frac{1}{2}$ medium
Blackberries	$\frac{2}{3}$ cup
Blueberries	$\frac{1}{2}$ cup
Cantaloupe	$\frac{1}{2}$ medium melon 1 cup diced
Cherries, sour	$\frac{1}{2}$ cup
Cherries, sweet	10 large cherries
Cherries, canned	$\frac{1}{2}$ cup
Cranberries	1 cup
Dates	2
Figs, fresh	2 small
Figs, dried	1 medium
Grapefruit	$\frac{1}{2}$ medium
Grapefruit juice	$\frac{1}{2}$ cup
Grapes	15 large
Honeydew	$\frac{1}{3}$ medium
Loganberries	$\frac{1}{2}$ cup
Nectarines	1 large
Orange	1 medium
Orange juice	$\frac{1}{2}$ cup
Peach	1 medium
Peach, canned	3 halves
Pear	$\frac{1}{2}$ large
Pear, canned, w.p.	2 halves
Pineapple	$\frac{1}{2}$ cup diced 1 slice
Plums	2 medium
Prunes	2 medium
Raspberries	$\frac{1}{2}$ cup
Strawberries	$\frac{3}{4}$ cup
Tangerines	1 medium
Watermelon	$\frac{3}{4}$ cup diced $\frac{1}{8}''$ slice

TABLE III. — FRUITS* AND VEGETABLES CLASSIFIED AS TO CARBOHYDRATE CONTENT[1]

Group I	Group II	Group III
3 per cent carbohydrate	6 per cent carbohydrate	9 per cent carbohydrate
Vegetables	Vegetables	Vegetables
Protein 2.0 Fat 0.3	Protein 2.0 Fat 0.3	Protein 2.5 Fat 0.3
Asparagus, fresh and canned	Beans, snap	Artichoke, globe
Bamboo shoots	Carrots, canned	Beets, fresh and canned
Beans, green, wax, canned	Celeriac	Brussels sprouts†
Bean sprouts (Mung)	Chives	Carrots
Beet greens	Collards	Onions
Broccoli	Dandelion greens	Peas, very young,† fresh and canned
Cabbage	Egg plant	Rutabagas
Cabbage, Chinese	Kale	Fruits*
Cauliflower	Kohlrabi	Protein 0.7 Fat 0.3
Celery	Lambsquarters	Applesauce, canned
Chard	Leeks	Apricots, w.p.
Chicory	Okra	Blackberries, fresh and canned, j.p.
Cucumber	Parsley	Blackberry juice
Dock	Peppers, red and green	Blueberries, w.p. and j.p.
Endive	Pimento, canned	Cherries, red and white, w.p.
Escarole	Pumpkin, fresh and canned	Cranberries
Fennel	Soy beans, green	Currants
Lettuce	Soybean sprouts	Gooseberries
Mustard greens	Squash, Cushaw	Grapefruit, fresh and canned
Okra, canned	Squash, winter	Grapefruit juice
Radishes	Taro	Groundcherry
Sauerkraut, fresh and canned	Turnips	Lemons and limes
Seakale	Fruits*	Loganberries, w.p.
Spinach, fresh and canned	Protein 0.7 Fat 0.3	Loganberry juice
Squash, summer	Blackberries, w.p.	Oranges, Mandarin
Tomatoes, fresh and canned	Cantaloupe	Peaches, j.p.
Tomato juice, fresh and canned	Gooseberries, w.p.	Pears, w.p.
Turnip tops	Honeydew and Spanish melons	Pricklypear
Water cress	Peaches, w.p.	Raspberries, w.p.
Fruits*	Plums, w.p.	Tangerines
Protein 0.7 Fat 0.3	Strawberries, fresh and canned	
Rhubarb, fresh and w.p.	Strawberry juice	
	Watermelon	

* Fruits listed are fresh unless otherwise indicated. Water-packed products are listed as w.p., and juice-packed products are listed as j.p.

† The protein content of these vegetables is higher than that listed for the group. See tables of food values for data.

TABLE III.—FRUITS* AND VEGETABLES CLASSIFIED AS TO CARBOHYDRATE CONTENT[1] (*Continued*)

Group IV	Group V	Group VI
12 per cent carbohydrate	15 per cent carbohydrate	18 per cent carbohydrate
Fruits*	Vegetables	Vegetables
Protein 0.7 Fat 0.3	Protein 2.5 Fat 0.3	Protein 2.5 Fat 0.3
Apple juice Applesauce, j.p. Apricots, fresh and j.p. Cherries, sour Cherries, red and white, j.p. Figs, w.p. Grapefruit juice, canned unsweetened Grapes, w.p. Guavas Kumquats Loganberries, fresh and j.p. Mulberries Oranges Orange juice, fresh and canned Peaches Pears, j.p. Pineapple, fresh and w.p. Pineapple juice, fresh and canned Plums Raspberries, fresh and j.p. Rose apple	Beans, Lima, canned† Jerusalem artichoke Mangos, tubers Peas, mature† Parsnips Salsify Shallot Fruits* Protein 0.7 Fat 0.3 Apple Blueberries Blueberry juice Cherries, black, w.p. Grapes Huckleberries Nectarines Papaws Pears Pineapple, j.p.	Corn, canned† Potatoes, Irish Fruits* Protein 0.7 Fat 0.3 Cherries, sweet Cherries, black, j.p. Crabapples Figs Grape juice Persimmons, Japanese Pomegranates Prune juice Prunes, j.p.

[1] Based on classification by the U. S. Department of Agriculture: *Proximate Composition of American Food Materials,* Circular No. 549, by Charlotte Chatfield and Georgian Adams, June 1940.

TABLE IV. — PERCENTAGES OF CERTAIN OF THE MINERAL ELEMENTS IN THE EDIBLE PORTIONS OF FOODS †

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulfur	Iron
Almonds	.254	.252	.759	.026	.475	.020	.150	.0044
Apples	.007	.006	.116	.010	.011	.004	.005	.0003
Apricots, dried	(.071)	*	*	*	(.113)	*	*	.0076
Apricots, fresh	.015	.009	.279	.030	.024	.002	.006	.0005
Artichokes, French	.039	.027	?	.025	.087	.057	.020	.0010
Asparagus	.021	.012	.187	.016	.052	.036	.046	.0012
Avocado	.019	.041	.653	.067	.046	.016	.037	.0014
Bacon, 10 – 15% protein	.012	.013	.239	.820	.109	1.251	.152	.0015
Banana	.008	.031	.373	.042	.028	.125	.012	.0006
Barley, entire	.075	.171	.485	.077	.373	?	.143	.0051
pearled	.016	.037	.110	.056	.189	?	.116	(.002)
Beans, dried	.148	.159	1.201	.103	.463	.035	.237	.0103
Lima, dried	.072	.181	1.727	.167	.380	.031	.178	.0090
Lima, fresh	.031	*	*	*	.112	*	*	.0023
snap or string	.065	.026	.251	.023	.044	.033	.030	.0011
Beef, lean	.013	.024	.338	.084	.204	.076	.230	.0030
Beet	.026	.023	.336	.079	.039	.061	.017	.0009
Beet greens	.134	.113	*	*	.039	*	*	.0032
Blackberries, seeds included	.032	.024	.181	.004	.032	.015	.017	.0009
seeds removed	.017	*	*	*	.019	.007	.008	(.0009)
Blueberries	.026	.010	.065	.016	.020	.008	.011	.0009
Bluefish	.023	.031	.315	.068	.235	.076	.241	.0010

† H. C. Sherman, *Chemistry of Food and Nutrition*, 6th ed., The Macmillan Company.
* Doubtless present but quantitative data have not been found
? Reports too discordant to average.
N. B. Data enclosed in parentheses are based on evidence either less consistent or less direct than in the majority of cases.

TABLE IV PERCENTAGES OF MINERAL ELEMENTS IN FOOD (*Continued*)

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulfur	Iron
Brazil nuts	.124	.225	.601	.026	.602	.081	.198	.0028
Bread, white	(.05)[a]	.030	.109	.446	(.10)[b]	.621	.054	.0009
whole wheat	(.06)[a]	(.15)	(.45)	[a]	(.37)	[a]	(.15)	.0030
Broccoli, E. P.	.146	.029	.395	.052	.072	.097	.145	.0014
flowerbuds	.101	.031	.408	.024	.107	*	*	*
leaves	.314	.041	.374	.064	.066	*	*	.0024
twigs	.073	.021	.361	.031	.038	*	*	*
Brussels sprouts	.025	*	*	*	.105	*	.184	.0011
Butter	.016	.001	.014	(.22)[c]	.016	(.33)[c]	.009	.0002
Cabbage, headed	.045	.012	.294	.032	.028	.039	.067	.0004
loose leaf, outer leaves, or greens	.429	.034	.402	.065	.072	.108	(.07)	.0018
general average	*	*	*	*	*	*	*	.0007
Cantaloupe	.017	.017	.249	.043	.016	.040	.015	.0004
Carrots	.042	.017	.311	.076	.040	.042	.021	.0007
Cashew nuts	.048	.267	*	*	.480	*	*	*
Cauliflower	.025	.020	.313	.041	.065	.031	.085	.0009
Celery	.072	.027	.291	.130	.046	.137	.022	.0007
Chard	.104[d]	.053	.318	.086	.050	.039	.124	.0031
Cheese, hard	.873	.042	.131	.88[c]	.610	1.35[c]	.218	(.001)
cottage	.082	*	*	*	.263	*	*	(.001)
Cherries	.017	.014	.246	.003	.022	.003	.008	.0005
Chestnuts	.034	.042	.529	.038	.090	.011	.048	.0008
Chicken (fowl)	.016	.027	.372	.091	.218	.079	.252	.0019

[a] Uncertain because of varying methods of breadmaking.
[b] Varies for the same reason, but in lesser degree.
[c] Varies with the amount of added salt.
[d] Calcium of chard is of very doubtful availability.

TABLE IV—PERCENTAGES OF MINERAL ELEMENTS IN FOOD (*Continued*)

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulfur	Iron
Chocolate	.095	?	.442	.056	.343	.071	.095	.0025
Clams	.102	.089	.172	.603	.105	1.065	.219	*
Cocoa	.112	.420	.900	.059	.709	.051	.203	.0027
Cocoanut, dried	.043	.077	.693	.053	.191	.225	.076	.0036
fresh	.021	.039	.363	.039	.098	.122	.032	.0020
milk	.024	?	?	.058	.029	.190	.032	.0001
Codfish	.014	.022	.339	.096	.188	.150	.203	.0015
Collards	.202	*	*	*	.074	*	*	.0016
Conch	.089	.246	*	*	.112	*	.315	.0012
Corn (maize)	.029	.121	.339	.036	.281	.045	.151	.0036
meal	.016	.084	.213	.039	.152	.146	.111	.0009
sweet	.009	.038	.113	.040	.120	.014	.046	.0005
Cranberries	.014	.007	.080	.006	.011	.005	.007	.0006
Cream	(.09)	(.01)	(.13)	(.03)	(.07)	(.08)	(.03)	.0002
Cucumbers, seeds included	.010	.009	.140	.010	.021	.030	.012	.0003
seeds removed	.006	*	*	*	.018	*	*	.0003
Currants, dried	.075	.030	.458	.018	.138	.029	?	.0027
fresh	.035	.015	.261	.007	.036	.013	.029	.0009
Currant juice	.016	.010	.185	(.006)	.013	.004	.005	*
Dandelion	.113	.036	.461	.168	.041	.099	.17	.0030
Dates	.072	.065	.675	.097	.060	.283	.065	.0021
Eggplant	.009	.015	.229	.015	.020	.047	.021	.0005
Eggs	.058	.013	.138	.140	.224	.120	.197	.0031
Egg white	.011	.011	.154	.170	.015	.161	.208	.0001
Egg yolk	.157	.016	.118	.056	.538	.124	.194	.0087
Endive and Escarole	.074	.013	.381	.060	.038	.071	.032	.0017

TABLE IV — PERCENTAGES OF MINERAL ELEMENTS IN FOOD (*Continued*)

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulfur	Iron
Farina	.021	.025	.120	.065	.125	.076	.155	.0008
Figs, dried	.223	.082	.990	.066	.104	.105	.069	.0031
fresh	.050	.021	.297	.007	.035	.016	.012	.0007
Fish [e]								
Flounder	.031	.025	.311	.107	.197	.151	.217	.0010
Flour, buckwheat	.010	.048	.130	.027	.176	.012	.071	.0012
Graham or entire wheat	.035	.122	.324	.160 [f]	.300	.177 [f]	.124	.0040
white	.015	.021	.130	.045	.101	.071	.109	.0013
Gooseberries	.022	.009	.149	.010	.028	.009	.015	.0005
Grapefruit	.017	.010	.198	.004	.018	.003	.008	.0003
juice	.010	.008	.139	.005	.017	.002	.005	.0002
Grapes	.017	.007	.254	.011	.021	.002	.009	.0006
Haddock	.040	.026	.314	(.66) [c]	.200	(1.07) [c]	.238	.0007
Halibut	.011	.024	.340	.111	.209	.088	.212	.0007
Ham, med.-lean	.022	.020	.383	[c]	.151	[c]	.225	.0022
Hazelnuts	.287	.140	.618	.019	.354	.067	.198	.0041
Heart	.010	.035	.370	.153	.236	.125	.296	.0062
Hominy	.011	.058	.174	?	.070	.046	?	(.001)
Honey	.005	.006	?	.005	.016	.019	.005	.0009
Huckleberries	.026	.010	.065	.016	.020	.008	.011	.0009
Kale	.181	.037	.387	.052	.067	.122	.115	.0025
Kidney	.016	.021	.238	.230	.287	.246	.190	.0065
Kohlrabi	.078	.037	.371	.050	.057	.053	.050	.0007

[e] Average fish is estimated to contain per 100 grams of protein as follows: 0.109 gram Ca; 0.133 gram Mg; 1.671 grams K; 0.373 gram Na; 1.148 grams P; 0.528 gram Cl; 1.119 grams S; 0.0055 gram Fe.

[f] Probably contained some added salt.

TABLE IV—PERCENTAGES OF MINERAL ELEMENTS IN FOOD (*Continued*)

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulfur	Iron
Lamb (Mutton)	.015	.024	.301	.084	.208	.085	.211	.0030
Lemon (or juice)	.021	.009	.148	.013	.012	.004	.008	.0003
Lentils, dry	.098	.086	.835	.057	.368	.060	.277	.0083
Lettuce[g]	.054[h]	.011	.311	.030	.031	.073	.018	.0011[h]
Liver	.008	.022	.298	.087	.373	.101	.251	.0121
Loganberries, fresh and canned	.027	.018	.177	.002	.024	.011	.011	.0021
Macaroni	.021	.034	.174	.018	.147	.052	.146	.0013
Mackerel	.015	.033	.418	.153	.261	.152	197	.0011
Maple sirup	.163	.019	.242	.011	.014	.028	.004	*
Meat[i]								
Milk, cow's	.118	.012	.143	.051	.093	.106	.034	.0002
Molasses**	.246	.081	1.238	.043	.034	.501	.050	.0093
Mushrooms	.014	.016	.384	.027	.098	.021	.051	.0007
Muskmelon	.017	.017	.249	.043	.016	.040	.015	.0004
Mutton	.015	.024	.301	.084	.208	.085	.211	.0030
Oatmeal (Oats)	.081	.145	.431	.071	.365	.049	.199	.0052
Okra, seeds included	.072	.038	*	*	.062	*	.014	.0007
seeds removed	.075	.043	*	*	.053	*	*	.0007

[g] Though several investigators have published at least partial analyses, the evidence available at time of writing does not show how far the varieties of lettuce differ in composition.

[h] Higher in loose-leaf than in headed lettuce.

[i] Average meat is estimated to contain per 100 grams protein as follows: 0.058 gram Ca; 0.118 gram Mg; 1.694 grams K; 0.421 gram Na; 1.078 grams P; 0.378 gram Cl; 1.146 grams S; 0.0150 gram Fe.

** The figures here given for molasses, based on findings reported by Sheets and Pearson (Mississippi Agr. Expt. Sta., Tech. Bull. No. 22, 1936) are probably applicable only to the extreme type of "genuine old-fashioned molasses of the deep South." The composition of what is usually called molasses, throughout the United States generally, is probably more nearly approximated by the data for Sirups as listed farther on in this table.

TABLE IV—PERCENTAGES OF MINERAL ELEMENTS IN FOOD (*Continued*)

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulfur	Iron
Olives[i]	.101	.012	.809	1.189[c]	.015	1.877[c]	.032	.0020
Onions	.032	.015	.183	.015	.044	.024	.068	.0005
Orange (or juice)	.025	.010	.181	.010	.019	.004	.008	.0003
Oysters	.068	.039	.204	.471	.172	.628	.180	.0071
Parsley	.193	*	*	*	.084	*	*	.0043
Parsnips	.057	.029	.417	.008	.080	.035	.026	.0007
Peaches	.009	.011	.256	.015	.018	.005	.007	.0003
Peanuts	.066	.167	.614	.039	.392	.041	.226	.0019
Pears	.013	.009	.129	.008	.016	.004	.007	.0003
Peas, dry	.073	.140	.979	.089	.397	.044	.196	.0060
fresh	.022	.027	.284	.019	.122	.033	.056	.0019
Pecans	.089	.152	*	*	.335	.050	.113	.0026
Pepper, green	.011	.012	.186	*	.025	.019	.019	.0004
Persimmons	.022	.009	.292	.011	.021	.002	.005	.0003
Pineapple	.016	.011	.214	.014	.011	.046	.007	.0003
Plums	.017	.011	.232	.004	.020	.002	.005	.0005
Pork, med.-lean	.010	.024	.304	.069	.215	.069	.206	.0022
Pork (10 per cent protein)	.006	.012	.169	.042	.108	.038	.115	.0015
Potatoes	.013	.027	.496	.024	.053	.035	.029	.0011
Prunes, dry	.062	.040	.848	.078	.093	.009	.028	.0035
Pumpkins	.021	.012	.457	.054	.044	.049	.013	.0008
Radishes	.037	.015	.229	.064	.031	.037	.031	.0010
Raisins	.055	.035	.708	.087	.110	.045	.042	.0030
Raspberries, seeds included	.040	.023	.190	.003	.037	.022	.018	.0009
seeds removed	.024	.020	(.14)	(.04)	.027	*	(.01)	(.0009)

[i] Pickled in brine

TABLE IV—PERCENTAGES OF MINERAL ELEMENTS IN FOOD (*Continued*)

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulfur	Iron
Raspberry juice	.024	.016	.134	.005	.012	*	.009	(.0008)
Rhubarb	.051	.016	.358	.017	.025	.053	.008	.0005
Rice, entire	.068	.119	.342	.078	.336	.023	?	?
white	.009	.028	.079	.028	.092	.006	?	.0007
Rye, entire	.061	.155	(.45)	.061	.369	(.04)	.146	.0048
flour	.018	.081	(.45)	.019	.278	(.04)	.134	.0013
Salmon	[k]	.029	.316	?	.289	?	.226	.0069
Shrimps	.075	.074	.404	[c]	.210	[c]	?	.0020
Syrups [l]	(.04)	(.01)	(.24)	?	(.014)	.042	?	(.004)
Soybean flour	.216	.223	?	?	.583	.024	(.3)	(.0027)
Spinach	.083[m]	.055	.489	.084	.048	.065	.027	.0034
Squash, summer, seeds removed	.015	.008	.150	.002	.015	*	*	.0004
winter, seeds removed	.019	.011	.320	.004	.028	*	*	.0006
Strawberries	.022	.012	.145	.007	.022	.011	.012	.0009
Sweet potato	.033	.024	.373	.027	.052	.085	.026	.0008
Tapioca	.012	.002	.020	.004	.012	.016	.004	(.001)
Tomatoes, seeds included	.011	.012	.268	(.02)	.027	(.04)	.014	(.0006)
seeds removed	.006	.010	.229	(.02)	.020	(.04)	.008	.0006
Tomato juice	.007	.010	.310	.015	.015	.055	.005	(.0004)
Turkey	.023	.028	.367	.130	.320	.123	.234	.0038

[k] The calcium content of the edible flesh of fresh salmon, carefully freed from bone, averages about 0.015 per cent. Canned salmon, however, ordinarily includes the bone, and according to the U. S. Department of Commerce, this should be reckoned as consumable and nutritionally available. With bone thus included, the calcium content of salmon averages about 0.194 per cent.

[l] Data here given are averaged from analyses of syrups of several types commonly sold for use as table syrups and in cooking. Such syrups are often called molasses. The differences in mineral composition, both between the different kinds of syrups and between syrup and molasses are relatively large.

[m] Not nutritionally available.

TABLE [illegible].—PERCENTAGES OF MINERAL ELEMENTS IN FOODS (Continued)

	Calcium	Magnesium	Potassium	Sodium	Phosphorus	Chlorine	Sulphur	Iron
Turnips	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Turnip tops	.254	.019	.307	.045	.058	.092	.054	.0033
Veal, med.-lean	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.205	.0024
Vinegar	.016	.011	.150	.020	.015	.047	.018	.0006
Walnuts	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Watercress	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Watermelon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wheat, entire	.057	.165	.465	.060	.374	.049	.171	.0057
Wine (average)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE V. — ACID-PRODUCING FOODS[1]

	Excess Acid* per 100 Gm.		Excess Acid per 100 Gm.
Bread		**Fish**	
Rye	6.8	Perch	5.3
White	7.1	Codfish, fresh	5.5
Wholewheat	7.3	Flounder	7.1
Cereals		Trout	8.9
Hominy	3.9	Sturgeon	9.0
Cornflakes	5.4	Mackerel	9.3
Cornmeal	7.1	Halibut	9.4
Rice, polished	8.1	Eel	9.9
Farina	9.6	Salmon, canned	10.7
Spaghetti	10.5	Salmon, fresh	11.0
Macaroni	10.5	Whitefish	11.3
Rice, puffed	11.0	Pike	11.8
Wheat, puffed	11.6	Oysters	15.2
Wheat, shredded	12.2	Haddock	16.1
Oatmeal	12.9	**Meat, Poultry**	
Cheese		Kidney, beef	7.6
American	5.5	Goose	7.7
Crackers		Tongue, beef	7.8
Saltines	8.2	Liver, beef	8.2
Soda crackers	8.2	Kidney, veal	8.4
Graham crackers	8.5	Pork, roast	8.5
Eggs		Heart, beef	9.1
Whites	5.2	Lamb chop	9.3
Yolks	25.6	Veal chop	9.8
Whole	11.1	Pork chop	10.0
Fats		Beef sirloin	10.6
Peanut butter	4.4	Lamb roast	10.7
Nuts		Chicken	10.7
Peanuts	3.9	Beef, lean	11.8
Pecans	7.4	Pork, fresh ham	11.9
Walnuts	7.9	Ham, smoked	12.5
Miscellaneous		Beef tenderloin	12.9
Corn	6.0	Rabbit	14.8
Chocolate	6.8	Squab	14.9

[1] Sources of data:

Sherman, H. C., and Gettler, A. O.: The Balance of Acid-Forming and Base-Forming Elements in Foods, and Its Relation to Ammonia Metabolism, J. Biol. Chem. *11*:323, 1912.

Waller, D. S.: *Nutritive Value of Foods*, Ann Arbor: George Wahr Company, 1939.

* The reaction of the food is expressed as the number of cc. of normal hydrochloric acid to which it is equivalent. The values are given for the edible portions of raw foods.

TABLE VI. — ALKALI-PRODUCING FOODS

	Excess Base* per 100 Gm.		Excess Base* per 100 Gm.
Fruits		**Vegetables**	
Currants, fresh	1.2	Asparagus	0.8
Blueberries	2.7	Squash, summer	1.1
Watermelon	2.7	Peas, fresh green	1.3
Pineapple, canned	2.9	Onions	1.5
Grapes	3.1	Pumpkin	1.5
Pears	3.6	Pepper, green	1.7
Apple	3.7	Eggplant	2.2
Grape juice	3.9	Okra	2.6
Raspberries, black	4.0	Turnips	2.7
Lemon juice	4.1	Squash, winter	2.9
Grapefruit	4.2	Radishes	2.9
Cherry juice	4.4	Kidney beans, canned	3.0
Raspberry juice	4.9	Mushrooms	4.0
Peaches	5.0	Cabbage	4.5
Blackberries	5.5	Chicory	4.8
Lemons	5.5	Collards	5.1
Banana	5.6	Broccoli	5.2
Oranges	5.6	Cauliflower	5.3
Orange juice	5.6	String beans	5.4
Avocado	5.7	Tomatoes	5.6
Nectarines	6.0	Sauerkraut	5.7
Cherries, sour	6.1	Brussels sprouts	6.0
Loganberries	6.6	Romaine	6.1
Strawberries	6.6	Tomato juice	6.2
Raspberries, red	6.7	Sweet potato	6.7
Apricots	6.8	White potato	7.0
Pineapple	6.8	Lettuce	7.4
Pineapple juice	7.0	Celery	7.8
Gooseberries	7.3	Cucumber	7.9
Cantaloupe	7.5	Rutabagas	8.5
Rhubarb	8.6	Kale	9.6
Dates	11.0	Carrots	10.8
Raisins	23.7	Beets	10.9
Apricots, dried	31.3	Parsnips	11.5
Olives	41.1	Lima beans, fresh	14.0
Figs	100.9	Chard	15.8
Nuts		Dandelion greens	19.5
Chestnuts	7.4	Spinach	27.0
Almonds	12.1	Lima beans, dried	41.7
Brazilnuts	13.0		
Milk			
Fresh	2.4		

*The reaction of the food is expressed as the number of cc. of normal sodium hydroxide to which it is equivalent.

TABLE VII. — PURINE CONTENT OF THE VARIOUS FOODS
(J. SCHMID AND G. BESSAU) *

100 Gm.	Bases N. in Gm.	Uric Acid in Gm.
Meat		
Beef	0.037	0.111
Veal	0.038	0.114
Mutton	0.026	0.078
Pork	0.041	0.123
Boiled ham	0.025	0.075
Smoked ham	0.024	0.072
Smoked salmon	0.017	0.051
Smoked tongue	0.055	0.165
Liverwurst	0.038	0.114
Blutwurst	0	0
Brains	0.028	0.084
Liver	0.093	0.279
Kidney	0.080	0.240
Sweetbreads	0.330	0.990
Lungs	0.052	0.156
Chicken	0.029	0.087
Squab	0.058	0.174
Goose	0.033	0.099
Venison	0.039	0.117
Pheasant	0.034	0.102
Bouillon (100 gms. Beef)	0.015	0.045
Fish and Egg		
Shellfish	0.039	0.117
Codfish	0.038	0.114
Eel (smoked)	0.027	0.081
Salmon (fresh)	0.024	0.072
Carp	0.054	0.162
Pike	0.045	0.135
Red herring	0.028	0.084
Herring	0.069	0.207
Trout	0.056	0.168
Sprot	0.082	0.246
Sardines	0.118	0.354
Sardel	0.078	0.234
Anchovies	0.145	0.465
Crabs	0.020	0.060
Oysters	0.029	0.087
Lobster	0.022	0.066
Hen egg	0	0
Caviar	0	0
Shad	0	0
Milk, Cheese, Cereals		
Milk	0	0
Edam cheese	0	0
Swiss cheese	0	0
Limburger cheese	0	0
Tilson cheese	0	0
Roquefort cheese	0	0

TABLE VII.—PURINE CONTENT OF THE VARIOUS FOODS (J. SCHMID AND G. BESSAU) * (*Continued*)

100 Gm.	Bases N. in Gm.	Uric Acid in Gm.
Cream cheese	0.005	0.015
Dairy cheese	0.022	0.066
Grits	0	0
Barley	0	0
Rice	0	0
Tapioca	0	0
Sago	0	0
Oatmeal	0	0
Millet	0	0
Rolls	0	0
Light bread	0	0
Vegetables		
Cucumbers	0	0
Lettuce	0.003	0.009
Radishes	0.005	0.015
Cauliflower	0.008	0.024
Garlic	Traces	Traces
Spinach	0.024	0.072
Carrot	0	0
Green cabbage	0.002	0.006
Red cabbage	0.002	0.006
Kohl-rabi	0.011	0.033
Celery	0.005	0.015
Asparagus	0.008	0.024
Onions	0	0
String beans	0.002	0.006
White potatoes	0.002	0.006
Shell beans	0.027	0.081
Lentils	0.054	0.162
Beans	0.017	0.051
Mushrooms	0.018	0.054
Peas	0.018	0.054
Fruits		
Bananas	0	0
Pineapple	0	0
Peaches	0	0
Grapes	0	0
Tomatoes	0	0
Pears	0	0
Plums	0	0
Whortleberries	0	0
Oranges	0	0
Apricots	0	0
Blueberries	0	0
Apples	0	0
Almond	0	0
Hazel Nuts	0	0
Walnuts	0	0

*Courtesy of California Dietetic Association.

TABLE VIII. — TABLES FOR HEIGHT AND WEIGHT WITHOUT CLOTHING [1]

WOMEN						MEN					
FT.	IN.	15 YR.	20 YR.	25 YR.	30 YR.	FT.	IN.	15 YR.	20 YR.	25 YR.	30 YR.
		90	95	97	100			92	101	105	109
4	*8*	*100*	*105*	*108*	*111*	*4*	*11*	*102*	*112*	*117*	*121*
		113	117	122	125			114	126	131	136
		91	96	99	102			94	103	107	111
4	*9*	*101*	*107*	*110*	*113*	*5*	*0*	*104*	*114*	*119*	*123*
		114	119	124	127			117	128	134	138
		92	98	101	104			96	105	109	113
4	*10*	*102*	*109*	*112*	*115*	*5*	*1*	*107*	*117*	*121*	*125*
		115	123	126	129			120	131	136	140
		94	100	103	105			99	108	112	115
4	*11*	*104*	*111*	*114*	*117*	*5*	*2*	*110*	*120*	*124*	*128*
		117	125	128	132			124	135	139	144
		96	103	104	107			102	111	115	118
5	*0*	*107*	*114*	*116*	*119*	*5*	*3*	*113*	*123*	*128*	*131*
		120	128	131	134			127	138	144	147
		99	105	107	110			105	114	119	122
5	*1*	*110*	*117*	*119*	*122*	*5*	*4*	*117*	*127*	*132*	*135*
		122	132	134	137			131	143	148	152
		102	108	111	113			109	118	123	125
5	*2*	*113*	*120*	*123*	*125*	*5*	*5*	*121*	*131*	*136*	*139*
		127	135	138	141			136	147	153	156
		104	111	113	116			113	122	126	129
5	*3*	*116*	*123*	*126*	*129*	*5*	*6*	*125*	*135*	*140*	*143*
		131	138	142	145			140	152	157	161
		108	113	116	119			116	125	130	132
5	*4*	*120*	*126*	*129*	*132*	*5*	*7*	*129*	*139*	*144*	*147*
		135	142	145	149			145	156	162	165
		112	117	120	123			120	129	133	136
5	*5*	*124*	*130*	*133*	*136*	*5*	*8*	*133*	*143*	*148*	*151*
		140	146	149	153			149	161	166	170
		115	121	123	126			123	132	137	141
5	*6*	*128*	*134*	*137*	*140*	*5*	*9*	*137*	*147*	*152*	*156*
		144	151	154	158			154	165	171	175
		119	124	127	130			128	136	141	145
5	*7*	*132*	*138*	*141*	*144*	*5*	*10*	*142*	*151*	*157*	*161*
		149	155	158	162			159	170	176	181

TABLE VIII.—TABLES FOR HEIGHT AND WEIGHT WITHOUT CLOTHING[1] (*Continued*)

WOMEN						MEN					
FT.	IN.	15 YR.	20 YR.	25 YR.	30 YR.	FT.	IN.	15 YR.	20 YR.	25 YR.	30 YR
		122	127	131	133			132	141	146	150
5	*8*	*136*	*141*	*145*	*148*	*5*	*11*	*147*	*156*	*162*	*167*
		153	159	163	167			165	175	182	188
		126	131	134	136			137	145	151	156
5	*9*	*140*	*145*	*149*	*151*	*6*	*0*	*152*	*161*	*168*	*173*
		158	163	167	170			171	181	189	194
		131	134	137	140			141	150	157	161
5	*10*	*145*	*149*	*152*	*155*	*6*	*1*	*157*	*166*	*174*	*179*
		163	168	171	174			176	186	195	201
		135	139	140	143			146	154	161	167
5	*11*	*150*	*154*	*156*	*159*	*6*	*2*	*162*	*171*	*179*	*185*
		168	173	176	179			182	192	201	208

THREE WEIGHTS GIVEN

1. Middle figures *in italics*, for medium build (medium bone weight for height). Average weight.

2. Upper figures for slender build (light bone weight for height). 10 per cent reduction from average weight.

3. Lower figures for large frame (heavy bone weight for height). 12½ per cent added to average weight (The ideal weight for 30 years should be maintained throughout life)

[1] Table from Life Extension Institute of New York City.

TABLE IX.* — NORMAL CONSTITUENTS OF THE BLOOD IN THE ADULT

Physical Measurements		
Specific gravity		1.025-1.029
Viscosity (water as unity)		4.5
Bleeding time (capillary)	minutes	1-3
Prothrombin time (plasma)	minutes	less than 20
Sedimentation rate (Wintrobe method)		
men	mm. in 1 hr.	0-9
women	mm. in 1 hr.	0-20
Hematological Studies		
Cell volume	per cent	39-50
Red blood cells	million per cmm.	4.25-5.25
White blood cells	per cmm.	5000-9000
Lymphocytes	per cent	25-30
Neutrophils	per cent	60-65
Monocytes	per cent	4-8
Eosinophils	per cent	0.5-4
Basophils	per cent	0-1.5
Platelets	per cmm.	125,000-300,000
Proteins		
Total protein (serum)	Gm. per 100 cc.	6.5-7.5
Albumin (serum)	Gm. per 100 cc.	4.5-5.5
Globulin (serum)	Gm. per 100 cc.	1.5-2.5
Albumin: Globulin Ratio		1.8-2.5
Fibrinogen (plasma)	Gm. per 100 cc.	0.2-0.5
Hemoglobin Males	Gm. per 100 cc.	14-17
Females	Gm. per 100 cc.	13-16
Nitrogen Constituents		
Nonprotein N (serum)	mg. per 100 cc.	20-36
(whole blood)	mg. per 100 cc.	25-40
Urea (whole blood)	mg. per 100 cc.	18-38
Urea N (whole blood)	mg. per 100 cc.	8-18
Creatinine (whole blood)	mg. per 100 cc.	1-2
Uric acid (whole blood)	mg. per 100 cc.	2.5-5.0
Amino acid N (whole blood)	mg. per 100 cc.	3-6
Blood Gases		
CO_2 content (serum)	volumes per cent	55-75
	mM per liter	(24.5-33.5)
CO_2 content (whole blood)	volumes per cent	40-60
	mM per liter	(18.0-27.0)
Oxygen capacity (whole blood)		
Males	volumes per cent	18.7-22.7
Females	volumes per cent	17.0-21.0
Oxygen saturation		
arterial blood	per cent	94-96
venous blood	per cent	60-85
Carbohydrates and Lipides		
Glucose (whole blood)	mg. per 100 cc.	70-120
Ketones — as acetone (whole blood)	mg. per 100 cc.	1.5-2
Fats (total lipoids) (serum)	mg. per 100 cc.	570-820
Cholesterol (serum)	mg. per 100 cc.	100-230
Bilirubin (serum)	mg. per 100 cc.	0.1-0.25
Icteric index (serum)	units	4-6

Acid Base Constituents		
Base, total fixed (serum)	m.eq. per liter	150-160
Sodium (serum)	mg. per 100 cc.	320-335
	m.eq. per liter	(139-146)
Potassium (serum)	mg. per 100 cc.	16-22
	m.eq. per liter	(4.1-5.6)
Calcium (serum)	mg. per 100 cc.	9.0-11.5
	m.eq. per liter	(4.5-5.8)
Magnesium (serum)	mg. per 100 cc.	1.0-3.0
	m.eq. per liter	(1.0-2.5)
Phosphorus, inorganic (serum)	mg. per 100 cc.	3.0-5.0
	m.eq. per liter	(1.0-1.6)
Chlorides, expressed		
as Cl (serum)	mg. per 100 cc.	352-383
	m.eq. per liter	(99-108)
as NaCl (serum)	mg. per 100 cc.	580-630
	m.eq. per liter	(99-108)
Sulfates, inorganic		
as SO_4 (serum)	mg. per 100 cc.	2.5-5.0
	m.eq. per liter	(0.5-1.0)
Lactic acid (venous blood)	mg. per 100 cc.	10-20
	m.eq. per liter	(1.1-2.2)
Serum protein base binding power	m.eq. per liter	(15.5-18.0)
Base bicarbonate HCO_3 (serum)	m.eq. per liter	(19-30)
pH (blood or plasma at 38°C.)		7.3-7.5
Miscellaneous		
Phosphatase (serum)	Bodansky units per 100 cc.	5
Iron (whole blood)	mg. per 100 cc.	46-55
Ascorbic acid (whole blood)	mg. per 100 cc.	0.75-1.50
Carotene (serum)	mcg. per 100 cc.	75-125

NORMAL CONSTITUENTS OF THE URINE OF THE ADULT

Specific gravity		1.010-1.025
Reaction	pH	5.5-8.0
Volume	cc. per 24 hours	800-1600

	Gm. per 24 hours
Total solids	55-70
Nitrogenous constituents	
Total nitrogen	10-17
Ammonia	0.5-1.0
Amino acid N	0.4-1
Creatine	none
Creatinine	1-1.5
Protein	none
Purine bases	0.016-0.060
Urea	20-35
Uric acid	0.5-0.7
Acetone bodies	0.003-0.015
Bile	none
Calcium	0.2-0.4
Chloride (as NaCl)	10-15
Glucose	none
Indican	0-0.030
Iron	0.001-0.005
Magnesium (as MgO)	0.15-0.30
Phosphate, total (as phosphoric acid)	2.5-3.5
Potassium (as K_2O)	2.0-3.0
Sodium (as Na_2O)	4.0-5.0
Sulfates, total (as sulphuric acid)	1.5-3.0

mg. = milligrams
mcg. = micrograms
m. eq. = milli-equivalents
Gm. = grams
cc. = cubic centimeters
cmm. = cubic millimeters

$$\text{m. eq. per liter} = \frac{\text{mg. per liter}}{\text{equivalent weight}}$$

$$\text{equivalent weight} = \frac{\text{atomic weight}}{\text{valence of element}}$$

$$\text{mM (millimols) per liter} = \frac{\text{mg. per liter}}{\text{molecular weight}}$$

volumes per cent = mM per liter x 2.24

* Sources of data for normal constituents of blood and urine:

1. Bodansky, M. and Fay, M.: *Laboratory Manual of Physiological Chemistry,* New York: John Wiley and Sons, 1937.

2. Peters, J. P. and Van Slyke, D. D.: *Quantitative Clinical Methods,* Vol. 1, Interpretations; Vol. 2, Methods, Baltimore: Williams and Wilkins Company, 1932.

3. Todd, J. C. and Sanford, A. H.: *Clinical Diagnosis by Laboratory Methods,* Philadelphia: W. B. Saunders, 1939.

HEALTH SCORE CARD [1]

Observe or Consider	Normal Conditions	Abnormal Conditions
Appetite	ready for meals, taking pleasure in eating health-building foods	excessively interested in food; disliking many foods; craving sweets
Breathing	deep; regular; with mouth closed and breath sweet	shallow; irregular; with mouth open; short winded on slight exertion; with offensive odor to breath
Color	of mucous membranes, ears, cheeks, lips, and fingernails, pink — pink glow to skin on all parts of body	of mucous membranes, ears, cheeks, lips and nails — pale
Digestion	good, as shown by complete unawareness of digestion	poor, as shown by belching, gas, indigestion, car sickness, occasional nausea, or vomiting
Disposition	cheerful, pleasant, even-tempered in times of stress	surly, irritable, grouchy, uncooperative, quick to anger
Elimination	once daily; with feces formed, soft, moist, free from odor; without laxatives	irregular; with feces hard, dry; not formed; having offensive odor; obtained with use of laxatives
Eyes	bright; free from underlying circles; not sensitive to light; having a direct, alert glance; without frowning or squinting	dull; with underlying circles; sensitive to bright light; with frowning, squinting, shifting glance
Facial Expression	radiating health whether animated or in repose; relaxed, showing happiness and courage	strained, tense, drawn; showing fatigue, worry, sadness
Gums	smooth; fitting tightly at the base of each tooth; free from bleeding	puffy, swollen, sore; bleeding easily; withdrawn from base of tooth
Hair	glossy, lustrous, alive; with scalp clean, pink, free from dandruff	coarse, dull, lifeless, falling, thin, too oily; with scalp pale in color, scaly, dry, dandruffy
Hands	free from tremor; with palms slightly yellow; with nails strong, not easily broken, smooth	showing tremor of fingers; with palms white or bluish; with nails which peel, break easily, or are ridged
Heart	steady (about 72 beats per minute); with strong, steady regular beats; without the person being aware of the heart beat	weak or irregular beat (resting pulse either above or below 72); with person aware of his heart beat

[1] Davis, A.: *Vitality Through Planned Nutrition*. New York: The Macmillan Company, 1944.

Observe or Consider	Normal Conditions	Abnormal Conditions
Mental Ability	alert, mentally eager; able to concentrate and think clearly	having sluggish thought processes; lacking intellectual eagerness; disinterested; forgetful; unable to concentrate
Mental Outlook	forward looking, courageous; unafraid; eager to attack any problem	apprehensive; easily depressed; disinterested; fearful of life
Moral Outlook	honest, courageous, fearless, willing to fight for what is right	afraid to stand for what is right; wanting something for nothing; cheating whenever possible
Muscle Tone	so firm that erect posture is unconsciously maintained	soft, flabby; unable to stand erect unless muscles are tensed
Neck	having no enlargement; with ligaments clearly seen on turning head	with fullness on either side of windpipe indicating enlarged thyroid glands
Nerves	steady, relaxed, permitting person to sleep easily	tense, irritable, unstable, flighty; causing person to bite fingernails and have difficulty in sleeping
Posture: Abdomen	flat because of contraction of vertical abdominal muscles anchored to raised sternum	protruding, sagging
Chest	high, well rounded; with raised sternum	hollow, sagging
Feet	directly forward; with weight distributed evenly on both feet, and body supported 60 per cent on ball of foot, 40 per cent on heel	toeing either in or out; with too much weight on heel or small toe border
Head	carried high; with ear on direct line with shoulder, hip, knee, and ankle joints; with chin at right angle to head; with back of neck in straight line from shoulders	thrown forward or too far back; with chin sagging or too high; with back of neck curved into a U
Hips	with buttocks down and forward; with pelvic bones forming support for internal organs; in profile, hip joint directly above knee and ankle joints	with buttocks too far back and carried high, and pelvic bone tipped forward so that internal organs are not supported
Legs	straight and at right angles to feet; with knee caps directly forward	with knee caps turned outward; with lower leg circling out and back from ankle

Observe or Consider	Normal Conditions	Abnormal Conditions
Shoulders	flattened into perpendicular plane; with shoulder tips back	rounded; with shoulder tips forward
Resistance to Infections	freedom from all infections and illness	susceptible to infections and illness of any kind
Skin	smooth, turgent, soft, slightly moist, faintly pink; free from bruises, even after severe blows	pale in color, dry, scaly, oily, with blemishes such as rashes, blackheads, white heads, boils; bruising easily
Skeletal Development:		
Chest	broad, rounded; with each rib under the one above	having pigeon chest, with narrow cavity and lower ribs flaring out
Face	well developed, proportionate, with forehead flat with relation to face	with narrow cheek bones, overhanging or underdeveloped forehead, and chin either receding or prominent
Joints	without enlargements	with enlargements causing knock-knees, bowed legs, and enlarged wrists
Mouth	having rounded arch and teeth well spaced	having teeth crowded together, narrow arch, and protruding, badly aligned teeth
Step	elastic, rhythmical; with body so well balanced as to make step silent	shuffling, waddling; with body so out of balance as to make step heavy
Teeth	immune to decay	showing active decay
Vitality	energetic; possessing stamina and endurance	listless, tiring easily; lacking endurance; sluggish of movement; possessing nervous energy rather than vitality
Weight	correct for age and height	underweight or overweight according to individual standards

CORRELATION OF LECTURE AND LABORATORY WORK IN NUTRITION AND COOKERY COURSES

This textbook can readily be used in any course planned according to the unit system of teaching as outlined by the National League of Nursing Education and the American Dietetic Association. Since these outlines are easily available it has not been deemed necessary to use textbook space for their repetition.

The above mentioned outline has been modified somewhat by the authors in the order of presentation of subject matter and the methods used for the presentation. This textbook is not the place to enter into a discussion of all the whys and wherefores of such modification, but a fair trial of various outlines has led to the conclusion that the schemes presented herein have been instrumental in retaining greater interest of students, and have more nearly duplicated situations with which the nurse might actually come in contact.

The cookery course is based on the tray system — that is, the student at each class period presents a tray at the assigned time to the instructor who criticizes the tray from all angles as though she were the patient. The student learns to prepare a simple breakfast tray, then luncheons, and finally dinners — gradually increasing the complexity of the preparation as experience is gained. The problem in cookery with relation to the patients is to consider each of these factors: (1) service of food on time; (2) the appeal which the tray makes to the eye; (3) the appeal which the food makes to the palate; (4) the retention of maximum nutritive value; and (5) the economy of materials and time. To satisfactorily cope with these factors requires experience, and the student who at each class session prepares a tray with all these points in mind will much more nearly satisfy even the difficult patient than the student who may know all the principles and methods of cookery but who cannot have all the foods ready to serve when needed.

The tray method of teaching cookery need not minimize the em-

phasis on all the principles and methods of cookery; in fact, there is more constant opportunity for review. For example, in the outline below, a complete discussion of eggs — including composition, place in the diet, purchasing factors, care in the home, principles of cookery, and methods of preparation — is given in lesson 3. The student prepares poached eggs for a simple breakfast as an application of the principles of egg cookery. Then, in later lessons, soft cooked eggs, puffy omelet, eggs a la goldenrod, scrambled eggs, and cheese soufflé all illustrate principles of cookery and their practical application, thus serving as an excellent review.

Correlation with the nutrition lectures is possible with this method of teaching cookery. Very few foods are sources of one nutrient only. While proteins are being discussed in nutrition, the cookery of milk and eggs is introduced in the laboratory work. The student is made aware of the other contributions which these foods make to the diet. Cereals, batters, and doughs are logically grouped with carbohydrate foods. Cheese, meat, and fish are more commonly used for luncheon and dinner dishes; as protein foods they will have been mentioned in the early lectures on protein, but the correlation with minerals and vitamins still holds good.

This outline is intended to serve as an illustration or guide for the instructor rather than as a fixed rule. It must always be adjusted to the preliminary training and needs of the particular group of students, to the number of hours allotted for classroom and laboratory work, to the library facilities, and to the laboratory and classroom equipment which is available. Repeated use of this outline has shown that in a two-hour class period it is possible to include adequate discussion of the required subject matter and yet allow sufficient time for each student to prepare meals similar to those suggested in the outline.

AN OUTLINE FOR THE CORRELATION OF LECTURE AND LABORATORY WORK FOR COURSES IN NUTRITION AND COOKERY*

Lectures — Eighteen 1-hour periods; two 1-hour examinations

Laboratory — Nineteen 2-hour periods; one 2-hour examination

Nutrition	Cookery	
	Discussion	Laboratory work†
A. Introduction 1. Development of science of nutrition Role of nutrition in the modern world Importance of nutrition to the nurse a. The nurse's own health b. Community responsibility Food in its relation to the body Signs of good and poor nutrition	1. Purpose of the course in cookery Methods of cookery Evaluation of foods and diets Methods of calculation Essentials of good tray service General instructions for laboratory work	Checking desk equipment Setting up trays correctly
B. Proteins 2. Proteins Importance Chemistry Amino acids Complete and incomplete proteins Functions Building Regulation Energy	2. Beverages Coffee Tea Cereal beverages Cocoa and chocolate	Toast Coffee

*See footnote at end of table.

† The food which illustrates the discussion for the day in question is listed first.

AN OUTLINE FOR THE CORRELATION OF LECTURE AND LABORATORY WORK FOR COURSES IN NUTRITION AND COOKERY* (*Continued*)

Nutrition	Cookery	
	Discussion	Laboratory work†
3. Proteins (Continued) Digestion Absorption Utilization Daily allowances Factors which affect Food sources Planning the daily diet for protein Effects of high and low intakes	3. Milk Eggs	Poached egg on toast Cocoa
C. Energy foods and energy metabolism 4. Carbohydrates and fats Composition Functions Digestion, absorption, and utilization Food sources Effects of excess and deficiency	4. Cereals	Cooked cereal Soft cooked egg Postum
5. Energy metabolism Definition Measurement of fuel values in food Calorie as a unit Bomb calorimeter Measurement of energy exchange in man Basal metabolism Factors which affect the level	5. Batters and doughs	Muffins Puffy omelet Tea

† The food which illustrates the discussion for the day in question is listed first.

AN OUTLINE FOR THE CORRELATION OF LECTURE AND LABORATORY WORK FOR COURSES IN NUTRITION AND COOKERY* (*Continued*)

Nutrition	Cookery: Discussion	Cookery: Laboratory work†
6. Energy metabolism (*Continued*) Total metabolism Factors which affect the level Calculation of daily energy needs Foods for energy Effects of excessive and deficient caloric intake	6. White sauces Cookery of a leafy vegetable	Eggs a la goldenrod Melba toast Buttered spinach
D. Mineral elements 7. Introduction Calcium, phosphorus Occurrence Functions Daily allowances Food sources Results of deficiency	7. Vegetables Preparation of baked apple	Broiled tomato Cream of pea soup French omelet Baked apple
8. Iron and iodine Occurrence Functions Daily allowances Food sources Results of deficiency	8. Fruits	Stewed fruit Scrambled eggs Buttered rice
9. Other minerals and their place in nutrition Acid-base balance	9. Salads Fruit sections Sandwiches Shellfish	Citrus fruit salad Oyster stew Sandwiches Hot chocolate
10. Examination		
E. Vitamins 11. Introduction Fat-soluble vitamins Chemistry Functions Daily allowances Results of deficiency	10. Desserts	Blanc mange with whipped cream Cream of tomato soup Main dish salad

† The food which illustrates the discussion for the day in question is listed first.

AN OUTLINE FOR THE CORRELATION OF LECTURE AND LABORATORY WORK FOR COURSES IN NUTRITION AND COOKERY* (*Continued*)

Nutrition	Cookery	
	Discussion	Laboratory work†
12. Water-soluble vitamins Ascorbic acid Thiamine	11. Cheese	Cheese soufflé Julienne green beans Plain or whipped gelatin dessert
13. Water-soluble vitamins (*Continued*) Other members of the B complex	12. Meat	Oven or pan broiled liver, chop, or steak Cabbage au gratin ½ grapefruit
F. 14. Water and cellulose Functions Daily allowances Food sources	13. Fish and poultry	Sautéed or baked fish Baked potato Mixed green salad Tapioca cream
	14. Fluid diets	Broth with egg Fruit juice, plain or albuminized Malted milk, eggnog Soft custard Junket
G. 15. Digestion, absorption, and utilization Review of discussion of each nutrient	15. Soft diets	Scraped or ground beef balls Mashed potato Strained vegetable Baked custard
H. The daily dietary 16. Planning the adequate diet For the nurse For the family	16. Moderate cost diets	Moderate cost diets for the day are planned by the student; each student prepares one meal, and then the three meals for the day are observed and criticized

† The food which illustrates the discussion for the day in question is listed first

AN OUTLINE FOR THE CORRELATION OF LECTURE AND LABORATORY WORK FOR COURSES IN NUTRITION AND COOKERY* (*Continued*)

NUTRITION	COOKERY	
	DISCUSSION	LABORATORY WORK†
17. Meal planning and marketing Adequacy Palatability Economy—factors of purchasing	17. Low cost diets	Each student prepares one of the low cost meals; the three meals are observed and criticized
18. Psychological factors in nutrition Racial food habits Individual likes and dislikes Effect of illness, dietary deficiencies, etc.	18. Field trip to dairy, meat packing plant, or market as available in the given community	
19. Safeguarding the food supply Food poisoning Preservation of foods Food legislation	19. Review	Each student is given opportunity to prepare food which she was not successful in preparing at the earlier lesson
20. Examination	20. Examination—the student to prepare a tray (breakfast, luncheon, or dinner) as assigned by the instructor at time of examination, and to present this tray for criticism, and for oral examination as to principles of cookery.	

* The outline for cookery has been adapted by the authors from the one in use at the Presbyterian Hospital in New York City. Particular thanks are due to Miss Nelda Ross, Director of the Department of Nutrition at Presbyterian Hospital, for permission to use this material, and to Miss Louise Stephenson, Director of Nutrition at Grasslands Hospital, Valhalla, New York, who so successfully worked out the plans from which this table was adapted.

† The food which illustrates the discussion for the day in question is listed first.

PLANNING THE COURSE IN DIET THERAPY

No outline will be given here for the course in diet therapy, since the conditions prevailing from one school to another vary so widely. However, the inexperienced teaching dietitian may benefit from the following suggestions.

The entire series of lectures in diet therapy should be planned by the instructor well in advance of the presentation of the course. Each of the chapters in this textbook must be studied by the students so that the educational requiremens of the various states may be entirely met. However, the order in which the chapters are assigned will be varied in each case. It is essential to plan the order of discussions with the instructors in medical nursing, surgical nursing, and pathology since the proper correlation of diet therapy with etiology, symptoms, pathological conditions, and complete treatment is one of the most important factors in the success of the course. It is advisable to plan the entire student's course so that the individual lectures in diet therapy will immediately follow the lectures in medical nursing. By such arrangement the student first learns of etiology, symptoms, pathology, and treatment from the instructors specially qualified in each subject. Of even greater importance is the fact that the teaching dietitian need not use valuable time assigned for her course in the discussion of this preliminary material, but can proceed directly to the dietary phases of treatment. For example, the study of diabetes is initiated in the classes in medical nursing, and pathology. With this background the student can readily understand the modifications of the diet which should be given in lectures immediately following the former classes.

In some schools the classes in medical and surgical nursing, pathology, and diet therapy, regrettably, are not given simultaneously. When this is the case, the dietitian will plan her course independently. The routine hospital diets should be studied first, since they are the ones with which the student commonly comes in contact. Since the student will recently have completed the study of normal

nutrition, it is wise then to proceed to modifications of the diet which are involved when the conditions of normal nutrition have not been met — that is, the diet which is necessary in various deficiency diseases. The student early becomes familiar with caloric, protein, and vitamin modifications, and is gradually introduced to the more complicated diets where consistency, salt, etc., are important elements. The material in this textbook is so arranged that the student progresses from the familiar to the unfamiliar, from the simple to the more difficult.

Ideally, laboratory work should be given together with the classroom discussions. Twenty one-hour lectures and eight two-hour laboratory periods are adequate for satisfactory instruction. Many schools, however, do not allow sufficient time nor a liberal enough budget for the inclusion of laboratory work in the study of diet therapy. The student should always receive practice in the preparation of foods of varying consistency at this time, if such practice has not already been given in the elementary course in cookery. The frequent use of demonstrations is an invaluable aid in the teaching of diet therapy. Sample menus for a whole day, rather than isolated meals, should be prepared so that the student can visualize the composite whole. The student should note the appearance of the trays, the size of portions allowed, the choice of foods; she will thus be able to readily appreciate the differences between the low calorie diet, the diabetic diet, the bland diet, etc. Whenever time allows, the demonstrations may be prepared by assigned students thus giving some practice in actual food preparation.

The success of the courses in nutrition and in diet therapy is measured by the ability of the student to apply the principles which have been learned. Opportunity is given for such application in the practical diet service which follows the classroom instruction. The amount of time allotted for such practice varies from four to eight weeks. The student plans special diets for groups of patients and then takes part in the service of these diets. She may be expected to prepare beverages and simple dishes, but it is not advisable to prepare the more complicated dishes. It is of vital importance that the nurse be given an opportunity to observe the effects of the diet on the patient. Thus, when trays are served, the student should visit the patients while they still have their trays. By such follow-up

it is possible for the nurse to observe the patient's reaction to the food which has been served to him, to encourage the patient whenever necessary, to assist in the instruction of the patient in the reasons for dietary modification, and to observe the effect of the diet on the progress of the patient — weight gain, weight loss, diabetic control, etc. When the student has actually seen the reception which the patient gave to the diet which she planned, she can better plan and serve the subsequent diets.

A very worth-while project is the selection of two or more patients for special case studies. The dietitian will suggest to the student such cases as present special dietary problems. A sample form for such case studies is given on page 661. These case studies may be presented to a small class for discussion and comparison.

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